5901 High Speed Dialup Modem

Hardware Manual

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1   Overview

The 5901 modem provides high-speed dial-up telephone communication for SCADAPack, TeleSAFE Micro16 and SmartWIRE controllers. The 5901 modem is a 5000 Series module and may be fully integrated into a DIN rail mounted controller system. Operating power is received from the I/O Bus and the 5901 modem requires no external power source.

The 5901 modem supports telephone line connection speeds up to 56k baud. The 5901 modem performs complete handshake and data rate negotiations and supports error correction and data compression modes to ensure data transfer integrity. Non-error correcting mode is also supported. The 5901 modem supports DTE speeds up to 115200 baud with speed buffering at all speeds. XON/XOFF or RTS/CTS flow control between DTE and 5901 modem are supported.

Auto-recovery circuitry in the 5901 modem ensures controlled modem operation at all times. The 5901 modem is reset to the factory default or user-defined settings whenever power is applied or when the modem receives an I/O Bus Reset signal from the controller. A modem reset may be performed using the modem control functions in TelePACE Ladder Logic and C Tools programs. The 5901 may also be reset from a remote location using a pre-defined dial sequence.

The 5901 modem supports the Hayes "AT" command set. The 5901 modem automatically determines the speed and format of the data sent from the DTE. Under AT operation the modem performs an autobaud/autoparity/autolength function on each AT command entered.

Telephone line protection consists of a three-electrode spark gap surge arrester from TIP and RING to chassis and a MOV from TIP to RING. The 5901 modem operates in environmental conditions of between – 40°C and +60°C and between 5% and 95% relative humidity.

2   Industry Canada Certification[1]

NOTICE: The Industry Canada label identifies certified equipment. This certification means that the equipment meets certain telecommunications network protective, operational and safety requirements. Industry Canada does not guarantee the equipment will operate to the user's satisfaction.

Before installing this equipment, users should ensure that it is permissible to be connected to the facilities of the local Telecommunications Company. The equipment must also be installed using an acceptable method of connection. The customer should be aware that the compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be made by an authorized Canadian maintenance facility designated by the supplier. Any repairs or alternations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

CAUTION: Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

AVIS: L'étiquette de l'Industrie Canada identifie le matériel homologué. Cette étiquette certifie que le matériel est conforme à certaines normes de protection, d'exploitation et de sécurité des réseaux de télécommunications. Industrie Canada n'assure toutefois pas que le matériel fonctionnera à la satisfaction de l'utilisateur.

Avant d'installer ce matériel, l'utilisateur doit s'assurer qu'il est permis de le raccorder aux installations de l'entreprise locale de télécommunication. Le matériel doit également être installé en suivant une méthod acceptée de raccordement. L'abonné ne doit pas oublier qu'il est possible que la conformité aux conditions énoncées ci-dessus n'empêchent pas la dégradation du service dans certaines situations.

Les réparations de matériel homologué doivent être effectuées par un centre d'entretien canadien autorisé, désigné par le fournisseur. La compagnie de télécommunications peut demander à l'utilisateur de débrancher un appareil à la suite de réparations ou de modifications effectuées par l'utilisateur ou a cause de mauvais fonctionnement.

Pour sa propre protection, l'utilisateur doit s'assurer que tous les fils de mise à la terre de la source d'énergie électrique, les lignes téléphoniques et les canalisations d'eau métalliques, s'il y en a, sont raccordés ensemble. Cette précaution est particulièrement importante dans les régions rurales.

AVERTISSEMENT: L'utilisateur ne doit pas tenter de faire ces raccordements lui-même; il doit avoir recours à un service d'inspection des installations électriques, ou à un électricien, selon le cas.

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[1] A certification label will be found on certified equipment. Equipment without this label is not certified.

3   Important Safety Information

Power, input and output (i/o) wiring must be in accordance with Class I, Division 2 wiring methods Article 501-4 (b) of the National Electrical Code, NFPA 70 for installations in the U.S., or as specified in Section 18-1J2 of the Canadian Electrical Code for installations within Canada and in accordance with the authority having jurisdiction.

WARNING !
EXPLOSION HAZARD - SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABILITY FOR CLASS 1, DIVISION 2.

WARNING !
EXPLOSION HAZARD – WHEN IN HAZARDOUS LOCATIONS, TURN OFF POWER BEFORE REPLACING OR WIRING MODULES.

WARNING !
EXPLOSION HAZARD - DO NOT DISCONNECT EQUIPMENT UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NONHAZARDOUS.

4 Installation

The 5901 High Speed Dial Up modem is available in two standard versions, the model 5901 and the model 5901SA. The model 5901 is a standard 5000 Series module that connects to the system I/O Bus as an integrated part of a Control Microsystems system. The model 5901SA is a stand-alone version of the 5901 and is used with other devices such as personal computers. Both versions of the modem are identical in every respect except that the 5901SA is powered using a 9VDC transformer and has rubber feet for desktop mounting.
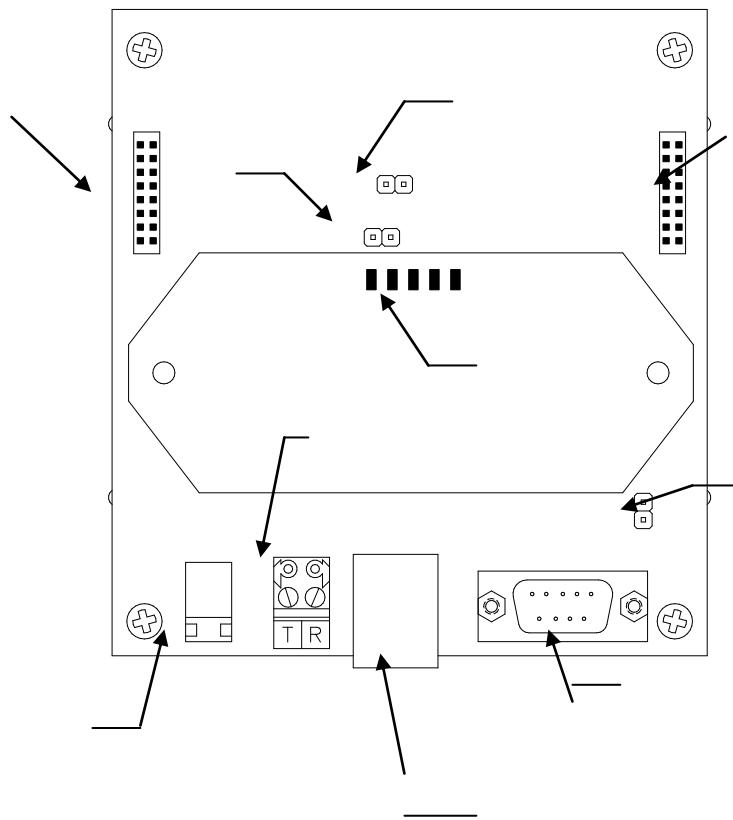
Figure1: 5901 Module Layout

4.1 Field Wiring

The 5901 modem has four connectors for field wiring. Refer to *Figure1: 5901 Module Layout* for the location of these connectors.

The RS-232 serial communication port, labeled P4, is a 9 pin female, D-sub-miniature connector, DE-9P. Refer to section *4.2-RS-232 Serial Port* for more information.

The telephone line connection is terminated at the 2 pole terminal block, labeled P3, or the RJ-11 modular jack, labeled P6. The RJ-11 modular jack is typically used. Refer to the section *4.3-Telephone Line Connection* for more information.

The 9VDC adapter connection, labeled P5, is used with the AD-119-9 transformer. This connection is used with the 5901SA modem only. Connector P5 is center pin positive.

Note:	The 9VDC adapter connection cannot be used in Hazardous Locations.

4.2   RS-232 Serial Port

The RS-232 port is a 9-pin female D-sub-miniature connector (DE-9P) configured as Data Communications Equipment (DCE). *Figure 2: RS-232 Port Connector (DCE)* and *Table 1: RS-232 Connections* describe the RS-232 connector.
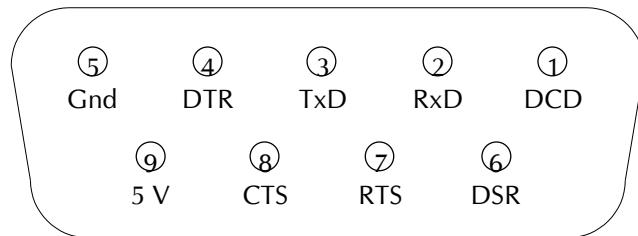
Figure 2: RS-232 Port Connector (DCE)

A description of each pin signal is shown in Table 1: RS-232 Connections. In this table a MARK is a voltage of +3 volts or greater and a SPACE is a voltage of –3 volts or less.

Table 1: RS-232 Connections

Pin	Type	Description
Pin1 DCD	Output	This signal is at a MARK level when carrier is detected by the modem on the receiver inputs. The CD led is on for a MARK level.
Pin 2 RxD	Output	Data received by the modem is output on this pin. The level is SPACE on standby and MARK for received data. The RD LED is on for a MARK level.
Pin 3 TxD	Input	Data transmitted by the modem is input on this pin from the DTE. The level is SPACE on standby and MARK for transmitted data. The TD LED is on for a MARK level.
Pin 4 DTR	Input	This signal indicates that the DTE is ready to receive data.
Pin 5 Ground		This pin is connected to the I/O system ground.
Pin 6 DSR	Output	This signal indicates the modem is ready to start communication. It is always in a MARK state.
Pin 7 RTS	Input	This input must be a MARK for the modem to transmit data. The DTE should set it to a MARK just before transmission of data. The CTS output will be asserted when the modem is ready to transmit data. The RS LED is on for a MARK level.
Pin 8 CTS	Output	This output indicates the modem is ready to transmit data. A MARK level indicates the modem is ready. The DTE should wait for this signal before transmitting data. The CS LED is on for a MARK level.

Pin	Type	Description
Pin 9 5 Volt Power	Input/ output	This pin may be connected to the 5V power supply by installing jumper J1. This pin is a power source for an external device when used as an output. It powers the modem when used as an input. This pin must NOT be connected if it is not used.

4.2.1   5901 Modem Connection to DTE

The serial cable that is provided with the 5901 modem is suitable for connecting the modem to a DTE (Data Terminal Equipment) device such as a SCADAPack controller, TeleSAFE Micro16 controller or a SmartWIRE 5202 Communication controller.

Other DTE devices such as a personal computer may require a longer serial cable. *Figure 3: RS-232 Wiring - 5901 (DCE) to DTE* shows a typical serial connection.
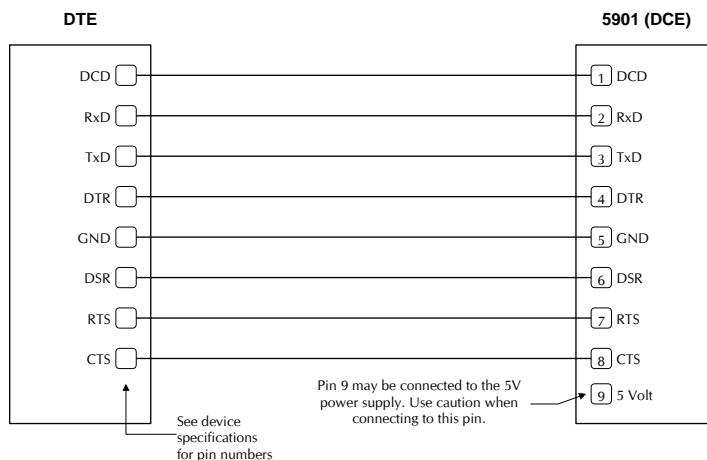
Figure 3: RS-232 Wiring - 5901 (DCE) to DTE

All RS-232 wiring exceeding the length of the serial cable supplied with the modem must use shielded cable. The shield should be connected to chassis ground at one end of the cable only. The DE-9 connector shell is a good ground point. A maximum cable length of 50ft (15.2m) is allowed. Failure to properly shield the cable may result in the installation not complying with FCC or DOC radio interference regulations.

4.3   Telephone Line Connection

The telephone line typically connects to the RJ-11 modular jack, labeled P3. The RJ-11 jack mates with a 4 pin modular plug with at least 4 contacts. This type of connector is common in the telephone industry. Pins 2 and 3 are the tip and ring connection. Pins 1 and 4 are not used. See *Figure 4: 5901 Modem RJ-11 Connection, P6*.

Alternately, the terminal block connection shown in *Figure 5: 5901 Terminal Block Connection, P3* allows direct wiring of the telephone line to the 5901 modem.

RJ-11 Conections
1. n/c
2. Telephone line Tip
3. Telephone line Ring
4. n/c

Figure 4: 5901 Modem RJ-11 Connection, P6

T   R
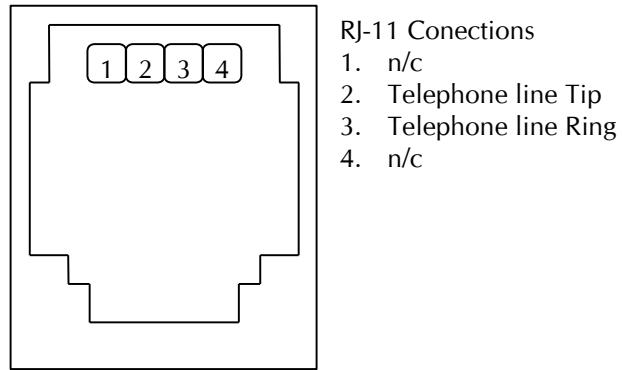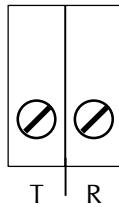
Figure 5: 5901 Terminal Block Connection, P3

4.4   Power Connections

- The 5901 modem may be powered in any one of the following ways:

- 5VDC applied to the 5901 from the I/O Bus.

- 9VDC applied to the 5901SA from P5.

- 5VDC applied to the 5901 from pin 9 on the RS-232 connector, P4.

4.4.1   I/O Bus Connection

The 5901 modem is normally powered through the connection to the system I/O Bus. The 5901 modem is connected to the system I/O Bus using a cable connected to P1 or P2. Refer to the *System Configuration Guide* for complete information on the system I/O Bus cabling.

4.4.2   5901 SA Power Connection

The 5901SA version of the modem is powered using a transformer connected to P5. The transformer plugs into a 120VAC supply and provides 9VDC to the 5901SA. The transformer is shipped with all 5901SA modems. To power the 5901SA modem using the transformer:

- Ensure the transformer is not connected to the 120VAC supply.

- Locate connector P5 on the 5901 modem. Refer to *Figure1: 5901 Module Layout* for the location of P5.

- Insert the small female plug on the transformer assembly into connector P5.

- Plug the transformer into a 120VAC supply.

Note:	The 9VDC adapter connection cannot be used in Hazardous Locations.

4.4.3 *RS-232 Connection*

The 5901 may be powered from pin 9 of the RS-232 connector, P4. There are a number of restrictions with respect to the 5VDC tolerance and fuse considerations. Contact Control Microsystems Technical Support for further information when using this method of powering the 5901 modem.

4.5 Configuration Jumpers

The 5901 modem uses three configuration jumpers for setting modem operation parameters. These jumpers are described in the table below. Refer to *Figure1: 5901 Module Layout* above for the location of each jumper.

Jumper	Description	Setting
J1	5V from P4 pin 9	When installed the 5901 uses 5VDC power from serial connection P4 pin 9. When powering the SCADAPack using this method, ensure jumper J2 is removed and jumper J4 is installed.
		When removed the 5901 is not powered from the serial connection. This is the normal position for 5901 and 5901SA.
J2	Module Reset	When installed the 5901 is reset by the I/O Reset signal from the system I/O Bus. This is the normal position for the 5901 when powered from the I/O bus, or from a SCADAPack's RS-232 port.
		When removed the 5901 is reset internally. This is the normal position for the 5901SA. Note that the 5901 is considered an SA only when it is powered using an external 115V AC to 9V DC transformer.
J4	DTR	When installed the DTR signal does not affect 5901 reset. This is the normal position for the 5901SA. Note that the 5901 is considered an SA only when it is powered using an external 115V AC to 9V DC transformer.
		When removed and the DTR signal is de-asserted the 5901 will reset. This is the normal position for the 5901, when powered from the I/O bus, or from a SCADAPack's RS-232 port.
J5	Chassis Ground	When installed the telephone line transient protection is connected to chassis ground. This is the normal position for the 5901, when powered from the I/O bus, or from a SCADAPack's RS-232 port.
		When removed the telephone line transient protection is not connected to chassis ground. This is the normal operation for the 5901SA. This is the normal position for the 5901SA. Note that the 5901 is considered an SA only when it is powered using an external 115V AC to 9V DC transformer.

4.6   5901 Modem Reset Control

A common problem encountered with consumer modems is the tendency to periodically go into an unstable state. The usual solution for this problem is to simply turn the modem off and then turn it on again. The modem then returns to normal operation.

When a modem is used in industrial or commercial applications that require it to be installed in very remote locations this solution is not feasible. The 5901 modem uses a number of methods to ensure stable operation in virtually all applications.

The 5901 modem is reset to the power up state under any of the following conditions.

- When power is applied from a power off state.

- When the controller RESET signal is active, indicating all I/O modules are to be reset.

- When the DTR signal is low. This is the normal signal from the DTE to reset the modem.

Note:	5901 modem will power up with the default configuration. User entered "AT" commands are not saved when power is cycled. When a configuration is used that is different than the default configuration it must be saved to NVRAM in the modem. Refer to the &W0 and &Y0 commands in Appendix C for more information on saving configurations to NVRAM.

4.6.1   Reset on Power Application

Each time power is applied to the 5901 modem it is reset. Power may be applied to the 5901 modem in the following ways:

- 5VDC applied to the 5901 from the I/O Bus.

- 5VDC applied to the 5901 from RS-323 connector pin 9.

- 9VDC applied to the 5901 from P5.

4.6.2   Reset on I/O Bus Reset Signal

When the SCADAPack or Micro16 controller RESET signal is TRUE, the modem is turned off and then turned on. Refer to SCADAPack & Micro16 Hardware manual for information on the controller RESET signal.

4.6.3   Reset on DTR Control

The 5901 modem will reset when the DTR line in the serial port is de-asserted. The DTE device connected to the 5901 may control the reset of the 5901 by asserting or de-asserting DTR.

4.6.4   Failure Recovery

If the 5901 modem detects 7 or more rings, in each of two ring attempts within 2 minutes, it will be reset. This mode allows the user to remotely reset the 5901 modem if failure occurs.

4.7   LED Indicators

The 5901 modem has five status LEDs. These LED's cannot be disabled to conserve power.

LED	Color	Function
TXD	Red	The TD LED is on when the DTE is transmitting data to the modem.
RXD	Red	The RD LED is on when data is being received by the modem.

LED	Color	Function
DSR	Red	The DSR LED is on when the modem is ready to start communication. It is always in a MARK state (on).
DTR	Red	The DTR LED is on when DTR is asserted by the DTE device.
OH	Red	The OH LED is on when the modem is off hook.

5   Operation

The operation of the 5901 modem is configured and controlled using commands or strings of commands. These commands are sent to the 5901 through the serial communication RS-232 port. Commands sent to the 5901 are referred to as AT commands. See section *10-AT Command Guidelines* for information on how the AT commands are structured.

The 5901 modem contains a pre-set operating configuration. This configuration is shown as the default settings in sections *10.2-*

AT Command Set *to10.10-At@ Command Set.*

The pre-set configuration enables the 5901 to operate in most situations but some changes to this configuration may be required to meet application demands.

The 5901 modem may be operated as a stand-alone modem; as part of a 5000 Series I/O system with a programmable controller, such as a SCADAPack or TeleSAFE Micro16; and as part of a 5000 Series I/O system with a non-programmable controller, such as a SmartWIRE 5202.

5.1   Stand Alone Modem Operation

When the 5901 modem is used as a stand-alone modem it is directly connected to a Personal Computer (PC). To configure and control the 5901 modem the PC executes a communication program, the TelePACE program or a host SCADA program.

5.1.1   5901 Modem Connection to PC

When used as a stand-alone modem the RS-232 serial communication port on the 5901 modem connects to a serial port on the PC. This connection is referred to as a DTE (PC) to DCE (5901 modem). See the section *4.2.1-5901 Modem Connection to DTE* for information on this connection.

5.1.2   Operation using Communication Software

The communication program controls the operation of the 5901 modem by sending configuration commands, or strings of commands to the modem. These commands are referred to as AT commands. See section *10.2-AT Command Guidelines* for information on how the AT commands are structured.

The documentation for the communication program used will contain information about how to send AT commands to the modem.

5.1.3   Operation using TelePACE program

The TelePACE program supports dial up connections to the SCADAPack, TeleSAFE Micro16 and TeleSAFE 16EX controllers. The TelePACE program controls the operation of the 5901 modem through the PC Serial Ports Setting dialog box. For complete information about the PC Serial Ports Setting refer to the *TelePACE Ladder Logic User Manual*.

To configure the TelePACE program to use the 5901 modem:

- From the Communication menu select PC Serial Port Settings.

- Ensure the settings on the right side of the PC Serial Ports Setting dialog box are correct for your application. These settings include Port, Protocol, Baud, Parity and Station.

| Note: | The **Port** setting is the serial port the PC will use to connect to the 5901 modem. |

- Select the **Dial Up** radio button.

- Enter the dialing information required to make connection with the remote controller. Some sample **Dialing Prefix** strings are shown below.

To connect to a remote controller that is using a 5901 modem use this command string:

<div align="center">

Dial Prefix   **&F0**

</div>

To connect to a remote TeleSAFE controller that is using a 6901 modem use this command string:

<div align="center">

Dial Prefix   **&F0 &K0**

</div>

5.1.4   *Operation with Host SCADA program*

The Host SCADA program controls the operation of the 5901 modem by sending configuration commands, or strings of commands to the modem. These commands are referred to as AT commands. See section *10.2-AT Command Guidelines* for information on how the AT commands are structured.

The documentation for the Host SCADA program used will contain information about how to send AT commands to the modem.

5.2   Operation with Programmable Controllers

The SCADAPack or TeleSAFE Micro16 controllers can control the operation of the 5901 modem using TelePACE Ladder Logic or C Tools programming software.

To configure the SCADAPack or TeleSAFE Micro16 controller and the 5901 modem for successful dial up communication the following steps are recommended.

- Configure the controller serial port to use the 5901 modem.

- Initialize the 5901 modem.

- Initiate a dial-up modem connection with another controller or SCADA host.

- Communicate with another controller or host after dial connection is made.

5.2.1   *Configure Controller Serial Communication Port*

The serial communication port that the controller uses to connect with the 5901 modem must be configured for *RS-232 Dial up modem*. The controller serial ports are configured using the TelePACE program. To configure the controller serial port:

- Select **Controller** from the TelePACE menu bar.

- Select **Serial Ports** from the Controller menu.

- In the Controller Serial Ports Settings dialog select **RS-232 Dial up modem** in the **Port Type** selection for the **com** port being used.

5.2.2   *Initializing the 5901 Modem*

The modem initialization setting determines the 5901 modem operation when the application program in the controller initiates a dial out or when a dial in is received from a remote modem. Application programs usually require that the modem be initialized at the start of the program.

TelePACE Ladder Logic uses the **INIM** function for initializing the 5901 modem. Refer to the *TelePACE Ladder Logic Reference and User* manual for complete information on this function.

The **Modem Command** entry box in the INIM element configuration is where the configuration commands are entered. When the INIM function is energized during a Ladder Logic program the command string that is in the Modem Command entry box is sent to the 5901 modem.

Note:	The INIM function automatically inserts the AT command when the command string is sent to the modem.
Note:	When using SCADAPack com3 or SCADAPack Plus com3 or com4 the 5901 configuration must disable hardware flow control. See the &K0 command in Appendix C for more information.

To initialize the 5901 to use the factory default settings, answer on the first ring and then save this configuration in user profile 0 the initialization string would look like this:

<div align="center">

&F0 S0=1 &W0 &Y0

</div>

where:

&F0   Sets the modem for factory defaults.

S0=1   Sets the modem to auto-answer after one ring.

&W0   This command saves all the configuration settings before it as user profile 0.

&Y0   To use the settings in user profile 0 the command &Y0 is used. The &Y0 command will select the configuration settings of user profile 0 after a hard reset (power cycle).

5.2.3   *Initiating Dial-Up Modem Connection*

The SCADAPack or TeleSAFE Micro16 controller may initiate a dial up connection using the TelePACE Ladder Logic DIAL function. Refer to the *TelePACE Ladder Logic Reference and User* manual for complete information on this function.

When the Ladder Logic DIAL function is energized the auto-recovery circuitry in the 5901 modem causes the 5901 modem to reset. The &Y0 command, in the INIM function above, ensures the 5901 modem uses user profile 0. Once the 5901 modem reset is complete the telephone number in the **Phone Number** box is sent to the 5901 modem. The 5901 modem then will attempt to connect with the remote modem.

Note:	When the &Y0 command is used in the INIM function no command string is required in the **Modem Initialization** box.
Note:	When using SCADAPack com3 or SCADAPack Plus com3 or com4 the 5901 configuration must disable hardware flow control. See the &K0 command in Appendix C for more information.

5.2.4   *Communicating with a Remote Controller*

Once a dial up connection has been made with a remote station the SCADAPack or TeleSAFE Micro16 controller may send information to, or receive information from, the remote station using the TelePACE Ladder Logic function MSTR. Refer to the *TelePACE Ladder Logic Reference and User* manual for complete information on this function.

5.3   Operation with Non-Programmable Controllers

When the 5901 modem is used with non-programmable controllers it operates as an answer only modem. This mode of operation is typically used with a SmartWIRE 5202 Communication Controller. The 5202 controller is not programmable and cannot send configuration commands to the 5901 modem.

The 5901 modem must be configured using a communication program. Refer to the section *5.1.2- Operation using Communication Software* for more information on using a communication program. The documentation for the communication program used will contain information about how to send AT commands to the modem. Once the modem is configured, the settings must be saved in the modem NVRAM.

When using the 5901 modem with the 5202 controller the default configuration must be changed for the modem to auto-answer. The default setting for the auto-answer register, S0, is 0.

The following AT command string is used to change the auto-answer setting and then save it to NVRAM:

AT &F0 S0=1 &W0 &Y0

where:

&F0   Sets the modem for factory default settings.

S0=1   Sets the modem to auto-answer after one ring.

&W0   Saves the settings to user profile 0.

&Y0   The modem will use the settings in user profile 0 after any power reset.

6   Maintenance

This module requires no routine maintenance. If the module is not functioning correctly, contact Control Microsystems Technical Support for more information and instructions for returning the module for repair.

7   Troubleshooting

To determine the source of a problem when using the 5901 modem always check the **status** register of the DIAL or INIM function. The value stored in status register will indicate the type of problem. Refer to the help file in the TelePACE program or to the *TelePACE Reference and User Manual*.

To determine the configuration of the 5901 modem use the &V command. The command format is:

AT &V

The modem will display the contents of all configuration registers. See section *10.2-*

AT Command Set for details on the &V command.

Problem	Solutions
Modem does not auto-answer.	Ensure modem is properly powered. Ensure telephone line is connected to modem. Check the setting of the S0 register. This register must have a value of at least 1 for the modem to auto-answer.
Modem will not dial out.	Ensure modem is properly powered. Ensure telephone line is connected to modem. Check the setting of the S6 register. Dial tone may not be present before this register times out.
Modems make connection but controllers do not communicate.	Check for correct station address in MSTR functions. Check that both stations are using same protocol. If the telephone line is noisy try using Modbus ASCII protocol.

8   Specifications

Disclaimer: Control Microsystems reserves the right to change product specifications without notice. For more information visit www.controlmicrosystems.com .

Telco Data Rate	300 to 56k bps
Data Compression and Error Correction	MNP 2-4, MNP 5, V42 bis, MNP 10
DTE Data Rate	Auto detect DTE speeds of 300, 600, 1200, 2400, 4800, 7200, 9600, 12000, 14400, 19200, 38400, and 57600 bps.
Features	Compatible with all ITU-T standard modems from 14,400 to 300 bps. Permanently stores modem settings in memory (NVRAM). Supports the industry-standard AT command set.
Ringer Equivalency Number	0.8B
Visual Indicators	TD: Transmitted data LED RD: Received data LED DTR: Data Transmitter Ready LED OH: Off Hook LED
Power Requirements	Model 5901 - 5V at 200mA Model 5901SA - 115 VAC at 10 VA for the 9Vdc, 500mA, 2.1mm, center pin positive AC adapter.
Field Termination	2 pole, removable terminal block 12 to 22 AWG 15 amp contacts RJ11C modular jack
Dimensions	4.25 inch (108 mm) wide 4.625 inch (118 mm) high 1.75 inch (44 mm) deep
Mounting	Model 5901 – 7.5 x 35 DIN rail Model 5901SA – desktop, rubber feet
Packaging	Corrosion resistant zinc plated steel with black enamel paint
Environment	5% RH to 95% RH, non-condensing -40°C to 70°C -40°F to 158°F

9   Approvals and Certifications

Safety	Non-Incendive Electrical Equipment for Use in Class I, Division 2 Groups A, B, C and D Hazardous Locations.
Digital Emissions	FCC Part 15, Subpart B, Class A Verification
Telecom	FCC approved, Part 68 Industry Canada CS-02 approved

10   AT Command Guidelines

Modem operation is controlled by generic AT commands. These AT commands may be basic AT (i.e., commands preceded by AT, AT&, AT%, AT*, AT\, AT), AT-, or AT#) or S-Register (e.g., S6=n) commands. The command syntax and operation guidelines governing each of these command categories are described in subsequent sections.

10.1   AT Command Format

A command line is a string of characters sent from a SCADAPack, TeleSAFE Micro16 controller or computer (DTE) to the 5901 modem (DCE) while the modem is in a command state. A command line has a prefix, a body, and a terminator.

Each command line (with the exception of the A/ command) must begin with the character sequence AT and must be terminated by a carriage return. Commands entered in upper case or lower case are accepted, but both the A and T must be of the same case.

The body is a string of commands restricted to printable ASCII characters (032 - 126). Space characters (ASCII 032) and control characters other than CR (ASCII 013) and BS (ASCII 010) in the command string are ignored.

The default terminator is the ASCII <CR> character. Characters that precede the AT prefix are ignored. The command line interpretation begins upon receipt of the carriage return character.

Characters within the command line are parsed as commands with associated parameter values. The basic commands consist of single ASCII characters, or single characters preceded by a prefix character (e.g., "&"), followed by a decimal parameter. Missing decimal parameters are evaluated as 0.

The 5901 modem supports the editing of command lines by recognizing a backspace character. When modem echo is enabled, the modem responds to receipt of a backspace or delete by echoing a backspace character, a space character, and another backspace. The hex value to be used for the backspace character is programmable through register S5.

The AT sequence may be followed by any number of commands in sequence, except for commands such as Z, D, or A. Commands following commands Z, D, or A on the same command line will be ignored. The maximum number of characters on any command line is 39 (including "A" and "T"). If a syntax error is found anywhere in a command line command, the remainder of the line will be ignored and the ERROR result code will be returned. Most commands entered with parameters out of range will not be accepted and the ERROR response will be returned to the DTE.

Commands will only be accepted by the modem once the previous command has been fully executed, which is normally indicated by the return of an appropriate result code. Execution of commands D and A, either as a result of a direct command or a re-execute command, will be aborted if another character is entered before completion of the handshake.

10.1.1   DTE Speed Auto Detect

The 5901 modem can automatically determine the speed and format of the data sent from the DTE. Under AT operation, the 5901 modem performs an autobaud / autoparity / autolength function on each AT header entered. The autolength / autoparity facility can detect 7- or 8-bit characters of even, odd, or no parity with one stop bit. The 5901 modem can sense DTE speeds of 300, 600, 1200, 2400, 4800, 7200, 9600, 12000, 14400, 19200, 38400, and 57600 bps.

10.1.2 Escape Code Sequence

When the 5901 modem has established a connection and has entered on-line data mode, it is possible to break into the data transmission in order to issue further commands to the modem in an on-line command mode. This is achieved by the DTE sending to the modem a sequence of three ASCII characters specified by register S2. The default character is '+'. The maximum time allowed between receipt of the last character of the three escape character sequence from the DTE and sending of the OK result code to the DTE is controlled by the S12 register.

10.2 AT Command Set

The 5901 modem will respond to the commands described below. Parameters applicable to each command are listed with the command description.

The default values, as shown for each configuration command, are those used in the 5901 modem factory profile 0.

10.2.1 A/ - Repeating a Command Line

If the prefix "A/" or "a/" is received, the modem immediately executes once again the body of the preceding command line. No editing is possible, and no termination character is necessary. A command line may be repeated multiple times in this manner. Responses to the repeated command line are issued using format of the original command line. If "A/" is received before any command line has been executed, the preceding command line is assumed to have been empty (that results in an OK result code).

10.2.2 AT - Read/Write S Parameter

The modem selects an S-Parameter, performs an S-Parameter read or write function, or reports the value of an S-Parameter.

      n   Establishes S-Parameter n as the last register accessed.

      n=v   Sets S-Parameter n to the value v.

      n?   Reports the value of S-Parameter n.

The parameter n can be omitted, in which case the last S-Parameter accessed will be assumed. The S can be omitted for AT= and AT?, in which case the last S-Parameter accessed will be assumed.

For example:

      ATS7   establishes S7 as the last accessed register.

      AT=40   sets the contents of the last register accessed to 40.

      ATS=20   sets the contents of the last register accessed to 20.

If the number "n" is outside the range of the S-Parameters available, the modem will return the ERROR message. If the value "v" is outside the range permitted for a given S-Parameter, the modem will return the ERROR message. Input and output are always in decimal format. Note that some S-Parameters are read-only.

In some cases, writing to the S-Parameter will appear to be accepted but the value will not actually be written.

Due to country restrictions, some commands will be accepted, but the value may be limited and replaced by a maximum or minimum value.

Minimum, maximum, and default values for S-Parameters may be altered with ConfigurACE.

10.2.3 A - Answer

The modem will go off-hook and attempt to answer an incoming call if correct conditions are met. Upon successful completion of answer handshake, the modem will go on-line in answer mode. This command may be affected by the state of Line Current Sense, if enabled. (Most countries do not require Line Current Sense.) Operation is also dependent upon +FCLASS command and country-specific requirements.

If +FCLASS=0 is selected, the modem will enter the connect state after exchanging carrier with the remote modem. If no carrier is detected within a period specified in register S7, the modem hangs up. Any character entered during the connect sequence will abort the connection attempt.

If +FCLASS=1, 1.0, or 2 is selected, the modem will go off-hook in V.21 answer mode. It will generate the V.21 2100 Hz answer tone for 3 ± 0.5 seconds and, following a delay of 70 ms, will proceed as if the +FTH=3 command were issued. At any stage up to (but excluding) the +FTH=3 command state, any character will abort the communication. (See the description of the +FTH command for details.)

10.2.4 Bn - CCITT or Bell

When the modem is configured to allow either option, the modem will select Bell or CCITT modulation for a line speed connection of 300 or 1200 bps. Any other line speed will use a CCITT modulation standard. The parameter value, if valid, is written to S27 bit 6.

B0   Selects CCITT operation at 300 or 1200 bps during Call Establishment and a subsequent connection. (Default.)

B1   Selects BELL operation at 300 or 1200 bps during Call Establishment and a subsequent connection.

Result Codes:

OK   n = 0 or 1.

ERROR   Otherwise.

10.2.5 Dn - Dial

This command directs the modem to go on-line, dial according to the string entered and attempt to establish a connection. If no dial string is supplied, the modem will go on-line and attempt the handshake in originate mode. In W-class models, the action of going off-hook is affected by the status of the Line Current Sense input, if line current sensing is enabled, and by the blacklist and delayed list.

> **Note:** If the ATD command is issued before the S1 register has cleared, the modem will respond with the NO CARRIER result code.

If +FCLASS=0 is selected, the modem will behave as a data modem and will attempt to connect to another data modem. The modem will have up to the period of time specified by register S6 or S7 to wait for carrier and complete the handshake. If this time expires before the modem can complete the handshake, the modem will go on-hook with the NO CARRIER response. This command will be aborted in progress upon receipt of any DTE character before completion of the handshake.

If +FCLASS=1, 1.0, or 2 is selected, the modem will behave as a facsimile modem and attempt to connect to a facsimile machine (or modem) by entering the HDLC V.21 channel 2 receive state (as if +FRH=3 had been issued). This command will be aborted upon receipt of any DTE character if the modem has not finished dialing. In this case, the modem will go on-hook and return to command mode after displaying the NO CARRIER message. If the modem has finished dialing, it proceeds as if the +FRH=3 command has been issued. (Refer to the +FRH command to determine how the modem behaves following this stage.)

10.2.6   Dial Modifiers

The valid dial string parameters are described below. Punctuation characters may be used for clarity, with parentheses, hyphen, and spaces being ignored.

0-9   DTMF digits 0 to 9.

*   The 'star' digit (tone dialing only).

The 'gate' digit (tone dialing only).

A-D   DTMF digits A, B, C, and D. Some countries may prohibit sending of these digits during dialing.

L   Re-dial last number: the modem will re-dial the last valid telephone number. The L must be immediately after the D with all the following characters ignored).

P   Select pulse dialing: pulse dial the numbers that follow until a "T" is encountered. Affects current and subsequent dialing. Some countries prevent changing dialing modes after the first digit is dialed.

T   Select tone dialing: tone dial the numbers that follow until a "P" is encountered. Affects current and subsequent dialing. Some countries prevent changing dialing modes after the first digit is dialed.

R   This command will be accepted, but not acted on.

S=n   Dial the number stored in the directory (n = 0 to 3). (See &Z.)

!   Flash: the modem will go on-hook for a time defined by the value of S29. Country requirements may limit the time imposed.

W   Wait for dial tone: the modem will wait for dial tone before dialing the digits following "W". If dial tone is not detected within the time specified by S7 (US) or S6 (W-class), the modem will abort the rest of the sequence, return on-hook, and generate an error message.

@   Wait for silence: the modem will wait for at least 5 seconds of silence in the call progress frequency band before continuing with the next dial string parameter. If the modem does not detect these 5 seconds of silence before the expiration of the call abort timer (S7), the modem will terminate the call attempt with a NO ANSWER message. If busy detection is enabled, the modem may terminate the call with the BUSY result code. If answer tone arrives during execution of this parameter, the modem handshakes.

&   Wait for credit card dialing tone before continuing with the dial string. If the tone is not detected within the time specified by S7 (US models) or S6 (W-class models), the modem will abort the rest of the sequence, return on-hook, and generate an error message.

,   Dial pause: the modem will pause for a time specified by S8 before dialing the digits following ",".

; Return to command state. Added to the end of a dial string, this causes the modem to return to the command state after it processes the portion of the dial string preceding the ";". This allows the user to issue additional AT commands while remaining off-hook. The additional AT commands may be placed in the original command line following the ";" and/or may be entered on subsequent command lines. The modem will enter call progress only after an additional dial command is issued without the ";" terminator. Use "H" to abort the dial in progress, and go back on-hook.

^ Toggles calling tone enable/disable: applicable to current dial attempt only.

( ) Ignored: may be used to format the dial string.

- Ignored: may be used to format the dial string.

<space> Ignored: may be used to format the dial string.

<i> Invalid character: will be ignored.

> If enabled by country specific parameter, the modem will generate a grounding pulse on the EARTH relay output.

10.2.7 En - Command Echo

The modem enables or disables the echo of characters to the DTE. The parameter value, if valid, is written to S14 bit 1.

E0 Disables command echo.

E1 Enables command echo. (Default.)

Result Codes:

OK n = 0 or 1.

ERROR Otherwise.

10.2.8 Hn - Disconnect (Hang-Up)

This command initiates a hang up sequence. This command may not be available for some countries due to PTT restrictions.

H0 The modem will release the line if the modem is currently on-line, and will terminate any test (AT&T) that is in progress. Country specific, modulation specific, and error correction protocol specific (S38) processing is handled outside of the H0 command.

H1 If on-hook, the modem will go off-hook and enter command mode. For US models, the modem will remain off-hook. For W-class models, the modem will return on-hook after a period of time determined by S7.

Result Codes:

OK n = 0 or 1.

ERROR Otherwise.

10.2.9 In - Identification

The modem reports to the DTE the requested result according to the command parameter.

I0 Reports product code. Example: 14400

I1   Reports the least significant byte of the stored checksum in decimal. Reports 255 if the prestored checksum value is FFh.

I2   Reports "OK".

I3   Reports identification codes in the form VX.X-F_A where:

     VX.X =   Firmware version (e.g., V3.00)

     F =   Firmware model and ROM size:

          V90 or V34 = V90 or V34 in 1M ROM

          V90_2M or V34_2M = V90 or V34 in 2M ROM

     A =   Application

          DLS = Desktop Serial

          DLP = Desktop Parallel

          DLL = Low Power PC Card

          DL3 = Low Power 3V

          DLG = Low Power World Class

     Example: V3.000-V90_2M_DLS

Note:	If RPI+ is enabled (see +Hn command), "Rockwell RPI ™" is appended.

I4   Reports OEM defined identifier string in either Hayes-compatible binary format (default) or ASCII format (selectable by ConfigurACE), e.g.:

              a007840284C6002F

              bC60000000

              r1005111151012000

              r3000111170000000

I5   Reports Country Code parameter (see +GCI command), e.g., B5.

I6   Reports modem data pump model and internal code revision, e.g.,

     RCV56DPF-PLL L8571A Rev 29.00/29.00

I7   Reports OK.

Result Codes:

OK   n = 0 to 7.

ERROR   Otherwise.

10.2.10   L – Speaker Volume

This command sets the speaker volume control. The parameter value, if valid, is written to S22 bits 0 and 1.

L0   Low volume.

L1   Low volume. (Default.)

L2   Medium volume.

L3   High volume.

Result Codes:

OK   n = 0 to 3.

ERROR   Otherwise.

10.2.11   M – Speaker Control

This command selects when the speaker will be on or off. The parameter value, if valid, is written to S22 bits 2 and 3.

M0   Speaker is always off.

M1   Speaker is on during call establishment, but off when receiving carrier. (Default.)

M2   Speaker is always on.

M3   Speaker is off when receiving carrier and during dialing, but on during answering.

Result Codes:

OK   n = 0 to 3.

ERROR   Otherwise

10.2.12   On - Return to On-Line Data Mode

This command determines how the modem will enter the on-line data mode. If in the on-line command mode, the modem enters the on-line data mode with or without a retrain. If in the off-line command mode (no connection), the modem reports ERROR.

O0   Enters on-line data mode without a retrain. Handling is determined by the Call Establishment task. Generally, if a connection exists, this command connects the DTE back to the remote modem after an escape (+++).

O1   Enters on-line data mode with a retrain before returning to on-line data mode.

O2   Fast retrain without speed change (used for diagnostic purpose only).

O3   Renegotiate rate without speed change (used for diagnostic purpose only.

O4   Renegotiate rate down one speed (used for diagnostic purpose only).

O5   Renegotiate rate up one speed (used for diagnostic purpose only).

Result Codes:

OK   n = 0 to 5 and a connection exists.

ERROR   Otherwise or if not connected.

10.2.13   P - Set Pulse Dial Default

This command forces pulse dialing until the next T dial modifier or T command is received. Sets S14 bit 5.

As soon as a dial command is executed which explicitly specifies the dialing mode for that particular call (e.g., ATDT...), this command is overridden so that all future dialing will be tone dialed. (See T command.)

This command may not be permitted in some countries.

Result Code: OK

10.2.14   Qn - Quiet Results Codes Control

The command enables or disables the sending of result codes to the DTE. The parameter value, if valid, is written to S14 bit 2.

Q0   Enables result codes to the DTE. (Default.)

Q1   Disables result codes to the DTE.

Result Codes:

OK   n = 0 or 1.

ERROR   Otherwise.

10.2.15   Sn - Read/Write S-Register

The modem selects an S-Register, performs an S-Register read or write function, or reports the value of an S-Register.

n   Establishes S-Register n as the last register accessed.

n=v   Sets S-Register n to the value v.

n?   Reports the value of S-Register n.

The parameter n can be omitted; in which case the last S-Register accessed will be assumed. The S can be omitted for AT= and AT?, in which case the last S-Register accessed will be assumed.

For example:

ATS7 establishes S7 as the last accessed register.

AT=40 sets the contents of the last register accessed to 40.

ATS=20 sets the contents of the last register accessed to 20.

If the number "n" is beyond the range of the S-Registers available, the modem will return the ERROR message. The value "v" is "MOD"ed with 256. If the result is outside the range permitted for a given S-Register the values will still be stored, but functionally the lower and higher limits will be observed. Input and output are always in decimal format. Note that some S-Registers are read-only.

In some cases, writing to the S-Register will appear to be accepted but the value will not actually be written. Due to country restrictions, some commands will be accepted, but the value may be limited and replaced by a maximum or minimum value.

Due to country restrictions, some commands will be accepted, but the value may be limited and replaced by a maximum or minimum value.

Minimum, maximum, and default values for S-Parameters may be altered with ConfigurACE.

10.2.16   T - Set Tone Dial Default

This command forces DTMF dialing until the next P dial modifier or P command is received. The modem will set an S-Parameter bit to indicate that all subsequent dialing should be conducted in tone mode. The DP command will override this command. Clears S14 bit 5.

This command may not be permitted in some countries. (See P.)

Result Code: OK

10.2.17   *Vn - Result Code Form*

This command selects the sending of short-form or long-form result codes to the DTE. The parameter, if valid, is written to S14 bit 3.

V0   Enables short-form (terse) result codes. Line feed is not issued before a short-form result code.

V1   Enables long-form (verbose) result codes. (Default.)

Result Codes:

OK   n = 0 or 1.

ERROR   Otherwise.

10.2.18   *Wn - Connect Message Control*

This command, in conjunction with S95 bits 0, 2, 3, and 5 (bits 2, 3, and 5 can be written directly by the host or by the +MR, +ER, and +DR commands, respectively), control the format of CONNECT messages. The actual result code messages reported reflect the W command setting and the S95 bit settings. (Also see +MR, +ER, and +DR commands.)

The W parameter value, if valid, is written to S31 bits 2 and 3.

W0   Upon connection, the modem reports only the DTE speed (e.g., CONNECT 19200). Subsequent responses are disabled. (Default.)

W1   Upon connection, the modem reports the line speed, the error correction protocol, and the DTE speed, respectively. Subsequent responses are disabled.

W2   Upon connection, the modem reports the DCE speed (e.g., CONNECT 14400). Subsequent responses are disabled.

Result Codes:

OK   n = 0, 1, or 2.

ERROR   Otherwise.

10.2.19   *Xn - Extended Result Codes*

This command selects the subset of the result code messages used by the modem to inform the DTE of the results of commands.

Blind dialing is enabled or disabled by country parameters. If the user wishes to enforce dial tone detection, a "W" can be placed in the dial string (see D command). The information below is based upon the default implementation of the X results table.

If the modem is in facsimile mode (+FCLASS=1, 1.0, or 2), the only message sent to indicate a connection is CONNECT without a speed indication.

X0   Disables reporting of busy tones unless forced otherwise by country requirements; send only OK, CONNECT, RING, NO CARRIER, ERROR, and NO ANSWER result codes. Blind dialing is enabled/disabled by country parameters. If busy tone detection is enforced and busy tone is detected, NO CARRIER will be reported. If dial tone detection is enforced or

selected and dial tone is not detected, NO CARRIER will be reported instead of NO DIAL TONE. The value 000b is written to S22 bits 6, 5, and 4, respectively.

X1   Disables reporting of busy tones unless forced otherwise by country requirements; send only OK, CONNECT, RING, NO CARRIER, ERROR, NO ANSWER, and CONNECT XXXX (XXXX = rate). Blind dialing enabled/disabled by country parameters. If busy tone detection is enforced and busy tone is detected, NO CARRIER will be reported instead of BUSY. If dial tone detection is enforced or selected and dial tone is not detected, NO CARRIER will be reported instead of NO DIAL TONE. The value 100b is written to S22 bits 6, 5, and 4, respectively.

X2   Disables reporting of busy tones unless forced otherwise by country requirements; send only OK, CONNECT, RING, NO CARRIER, ERROR, NO DIALTONE, NO ANSWER, and CONNECT XXXX. If busy tone detection is enforced and busy tone is detected, NO CARRIER will be reported instead of BUSY. If dial tone detection is enforced or selected and dial tone is not detected, NO DIAL TONE will be reported instead of NO CARRIER. The value 101b is written to S22 bits 6, 5, and 4, respectively.

X3   Enables reporting of busy tones; send only OK, CONNECT, RING, NO CARRIER, ERROR, NO ANSWER, and CONNECT XXXX. Blind dialing is enabled/disabled by country parameters. If dial tone detection is enforced and dial tone is not detected, NO CARRIER will be reported. The value 110b is written to S22 bits 6, 5, and 4, respectively.

X4   Enables reporting of busy tones; send all messages. The value 111b is written to S22 bits 6, 5, and 4, respectively. (Default.)

Result Codes:

OK   n = 0 to 4.

ERROR   Otherwise.

Refer to *12-Modem Result Codes* for more information.

10.2.20   *Zn - Soft Reset and Restore Profile*

The modem performs a soft reset and restores (recalls) the configuration profile according to the parameter supplied. If no parameter is specified, zero is assumed.

Z0   Soft reset and restore stored profile 0.

Z1   Soft reset and restore stored profile 1.

Result Codes:

OK   n = 0 or 1.

ERROR   Otherwise.

10.3   AT& Command Set

10.3.1   *&Cn - RLSD (DCD) Option*

The modem controls the RLSD output in accordance with the parameter supplied. The parameter value, if valid, is written to S21 bit 5.

&C0   RLSD remains ON at all times.

&C1   RLSD follows the state of the carrier. (Default.)

Result Codes:

OK   n = 0 or 1.

ERROR   Otherwise.

10.3.2   &Dn - DTR Option

This command interprets the ON to OFF transition of the DTR signal from the DTE in accordance with the parameter supplied. The parameter value, if valid, is written to S21 bits 3 and 4. Also, see S25.

&D0   DTR drop is interpreted according to the current &Qn setting as follows:

&Q0, &Q5, &Q6	DTR is ignored (assumed ON). Allows operation with DTEs which do not provide DTR.
&Q1	DTR drop causes the modem to hang up. Autoanswer is not affected.
&Q2, &Q3	DTR drop causes the modem to hang up. Autoanswer is inhibited.

&D1   DTR drop is interpreted according to the current &Qn setting as follows:

&Q0, &Q1, &Q5, &Q6	DTR drop is interpreted by the modem as if the asynchronous escape sequence had been entered. The modem returns to asynchronous command state without disconnecting.
&Q2, &Q3	DTR drop causes the modem to hang up. Autoanswer is inhibited.

&D2   DTR drop is interpreted according to the current &Qn setting as follows:

&Q0 through &Q6	DTR drop causes the modem to hang up. Autoanswer is inhibited. (Default.)

&D3   DTR drop is interpreted according to the current &Qn setting as follows:

&Q0, &Q1, &Q5, &Q6	DTR drop causes the modem to perform a soft reset as if the Z command was received. The &Y setting determines which profile is loaded.
&Q2, &Q3	DTR drop causes the modem to hang up. Autoanswer is inhibited. If &Q5, &Q6, +FCLASS=1 or +FCLASS=2 is in effect, the action taken is the same as for &Q0.

10.3.3   &Fn - Restore Factory Configuration (Profile)

The modem loads the factory default configuration (profile). The factory defaults are identified for each command and in the S-Register descriptions. A configuration (profile) consists of a subset of S-Parameters.

&F0   Restore factory configuration 0.

&F1   Restore factory configuration 1.

Result Codes:

OK

ERROR   If the modem is connected.

10.3.4   &Gn - Select Guard Tone

This command causes the modem to generate the guard tone selected by this command (DPSK modulation modes only).

The parameter value, if valid, is written to S23 bits 6 and 7.

&G0 Disables guard tone. (Default)

&G1 Disables guard tone.

&G2 Selects 1800 Hz guard tone. This command may not be permitted in some countries.

Result Codes:

OK   n = 0 to 2.

ERROR   Otherwise.

10.3.5   &Kn - Flow Control

This command defines the DTE/DCE (terminal/modem) flow control mechanism. The parameter value, if valid, is written to S39 bits 0, 1, and 2.

&K0 Disables flow control.

&K3 Enables RTS/CTS flow control. (Default for data modem modes.)

&K4 Enables XON/XOFF flow control.

&K5 Enables transparent XON/XOFF flow control.

Result Codes:

OK   n = 0, 3, 4 or 5.

ERROR   Otherwise.

10.3.6   &Ln - Leased Line Operation

This command requests leased line or dial-up operation. This command is provided for compatibility only; no mode change is performed, dial-up operation continues. The OK response is returned for a valid parameter, but no other action is performed. The parameter value, if valid, is written to S27 bit 2.

&L0 Requests dial-up operation. Dial-up operation continues.

Result Codes:

OK   n = 0.

ERROR   Otherwise.

10.3.7   &Mn - Asynchronous/Synchronous Mode Selection

This command determines the DTR operating mode. The modem treats the &M command as a subset of the &Q command.

&M0 Selects direct asynchronous operation. The command sequence &M0\N0 selects normal buffered mode, but the command sequence \N0&M0 selects direct mode. This is because the \N0 command is analogous to the &Q6 command. The value 000b is written to S27 bits 3, 1, and 0, respectively. (See &Q).

&M1 Selects synchronous connect mode with async off-line command mode. The value 001b is written to S27 bits 3, 1, and 0, respectively. (Serial interface operation only.)

&M2 Selects synchronous connect mode with async off-line command mode. Same as &M1 except that &M2 enables DTR dialing of directory slot 0. The modem will disconnect if DTR is OFF for more than the period in S25 (in units of hundredths of a second): the data connection will be synchronous. The value 010b is written to S27 bits 3, 1, and 0, respectively. (Serial interface operation only.)

&M3 Selects synchronous connect mode. This mode allows DTR to act as a talk/data switch. The call is manually initiated while DTR is inactive. When DTR becomes active, the handshake proceeds in originate or answer mode according to S14 bit 7. The value 011b is written to S27 bits 3, 1, and 0, respectively. (Serial interface operation only.)

Result Codes:

OK   n = 0 to 3.

ERROR   Otherwise.

10.3.8   &Pn - Select Pulse Dial Make/Break Ratio

This command determines the make/break ratio used during pulse dialing. It is only effective if the appropriate bit to enable this command is set through the ConfigurACE program. If enabled, it will override the make/break ratios in the OEM parameters in ConfigurACE. The default is country-dependent. The parameter value, if valid, is written to S28 bits 3 and 4.

&P0 Selects 39%-61% make/break ratio at 10 pulses per second. (Default.)

&P1 Selects 33%-67% make/break ratio at 10 pulses per second.

&P2 Selects 39%-61% make/break ratio at 20 pulses per second.

&P3 Selects 33%-67% make/break ratio at 20 pulses per second.

Result Codes:

OK   n = 0 to 3.

ERROR   Otherwise.

10.3.9   &Qn - Sync/Async Mode

This command is an extension of the &M command and is used to control the connection modes permitted. It is used in conjunction with S36 and S48. (Also, see \N.)

Note:	When the &Q0 to &Q3 command is issued to select the mode, the subsequent connect message will report the DCE speed regardless of the W command and S95 settings.

&Q0 Selects direct asynchronous operation. The value 000b is written to S27 bits 3, 1, and 0, respectively. See &M0.

&Q1 Selects synchronous connect mode with async off-line command mode. The value 001b is written to S27 bits 3, 1, and 0, respectively. See &M1. (Serial interface operation only.)

&Q2   Selects synchronous connect mode with async off-line command mode and enables DTR dialing of directory 0. The value 010b is written to S27 bits 3, 1, and 0, respectively. See &M2. (Serial interface operation only.)

&Q3   Selects synchronous connect mode with async off-line command mode and enables DTR to act as Talk/Data switch. The value 011b is written to S27 bits 3, 1, and 0, respectively. See &M3. (Serial interface operation only.)

&Q5   The modem will try to negotiate an error-corrected link. The modem can be configured using S36 to determine whether a failure will result in the modem returning on-hook or will result in fallback to an asynchronous connection. The value 101b is written to S27 bits 3, 1, and 0, respectively. (Default.)

&Q6   Selects asynchronous operation in normal mode (speed buffering). The value 110b is written to S27 bits 3, 1, and 0, respectively.

Result Codes:

OK   n = 0 to 6.

ERROR   Otherwise.

10.3.10   &Rn - RTS/CTS Option

This selects how the modem controls CTS. CTS operation is modified if hardware flow control is selected (see &K command). The parameter value, if valid, is written to S21 bit 2.

&R0   In sync mode, CTS tracks the state of RTS; the RTS-to-CTS delay is defined by S26. In async mode, CTS is normally ON and will turn OFF only if required by flow control.

&R1   In sync mode, CTS is always ON (RTS transitions are ignored); In async mode, CTS is normally ON and will turn OFF only if required by flow control.

Result Codes:

OK   n = 0 or 1.

ERROR   Otherwise.

10.3.11   &Sn - DSR Override

This command selects how the modem will control DSR. The parameter value, if valid, is written to S21 bit 6.

&S0   DSR will remain ON at all times. (Default.)

&S1   DSR will become active after answer tone has been detected and inactive after the carrier has been lost.

Result Codes:

OK   n = 0 or 1.

ERROR   Otherwise.

10.3.12   &Tn – Local Analog Loopback Test

The modem will perform the local analog loopback test if &T1 is selected. The test can be run only when in an asynchronous operation in non-error-correction-mode (normal). To terminate the test in progress, the escape sequence must be entered first.

&T0   Terminates test in progress. Clears S16.

&T1   Initiates local analog loopback, V.54 Loop 3. Sets S16 bit 0. If a connection exists when this command is issued, the modem hangs up. The CONNECT XXXX message is displayed upon the start of the test.

10.3.13   &V - Display Current Configuration and Stored Profiles

This command reports the current (active) configuration, the stored (user) profiles, and the first four stored telephone numbers. The stored profiles and telephone numbers are not displayed if the NVRAM is not installed or is not operational as detected by the NVRAM test during reset processing.

Result Code: OK

Example:

AT&V

ACTIVE PROFILE:

B0 E1 L1 M1 N1 QO T V1 W0 X4 Y0 &C0 &D0 &G2 &J0 &K3 &Q5 &R1 &S0 &T4 &X0 &Y0

S00:002 S01:000 S02:043 S03:013 S04:010 S05:008 S06:002 S07:030 S08:002 S09:006 S10:014 S11:255 S12:050 S18:000 S25:005 S26:001 S36:007 S37:000 S38:020 S46:138 S48:007 S95:000

STORED PROFILE 0:

B0 E1 L1 M1 N1 QO T V1 W0 X4 Y0 &C0 &D0 &G2 &J0 &K3 &Q5 &R1 &S0 &T4 &X0

S00:002 S02:043 S06:002 S07:030 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000 S36:007 S37:000 S40:105 S41:003 S46:138 S95:000

STORED PROFILE 1:

B0 E1 L1 M1 N1 QO T V1 W0 X4 Y0 &C0 &D0 &G2 &J0 &K3 &Q5 &R1 &S0 &T4 &X0

S00:002 S02:043 S06:002 S07:030 S08:002 S09:006 S10:014 S11:095 S12:050 S18:000 S36:007 S37:000 S40:105 S41:003 S46:138 S95:000

TELEPHONE NUMBERS:

0 = 1 =

2 = 3 =

OK

10.3.14   &V1 - Display Last Connection Statistics

Displays the last connection statistics in the following format (shown with typical results):

TERMINATION REASON………LOCAL REQUEST

LAST TX rate....………….......…   26400 BPS

HIGHEST TX rate.......……….   26400 BPS

LAST RX rate...........………….   49333 BPS

HIGHEST RX rate........……….   49333 BPS

PROTOCOL................………….   LAPM

COMPRESSION.................……..	V42Bis
Line QUALITY..............………..	038
Rx LEVEL................………….	015
Highest Rx State........…………	67
Highest TX State........…………	67
EQM Sum..............…………..	00B4
Min Distance.............……..…	0000
RBS Pattern.............…………..	00
Rate Drop...............………….	00
Digital Loss.............………….	2000
Local Rtrn Count........…………	00
Remote Rtrn Count......……….	00

Flex 9481814347C4

RBS Pattern: Shows which bits are being robbed in the least significant 6 bytes, e.g., 03 indicates 2 robbed bits in bit positions 0 and 1.

Digital Loss: Shows if a pad was encountered and if so, what was the digital loss. 2000 means 0dB.

Flex: Shows V.8bis information as follows:

First byte: Octet 13 (second byte of manufacturer id, 94 = K56flex)

Second byte: Octet 14 (Licensee code: 81 = Rockwell)

Third byte: Octet 15 (manufacturer's product capabilities)

Fourth byte: Octet 16 (K56flex version number)

Fifth byte: Octet 17 (Rockwell pump code version number)

Sixth byte: Octet 18 (x-law and controller version number)

Bit 6 Forced/Not forced A-Law/m-Law

0 = Forced A-Law/m-Law

1 = Not forced A-Law/m-Law

Bit 5 Select A-Law or m-Law

0 = Select A-Law

1 = Select m-Law

Bit 4:0 Controller version

10.3.15   &Wn - Store Current Configuration

Saves the current (active) configuration (profile), including S-Registers, in one of the two user profiles in NVRAM as denoted by the parameter value. This command will yield an ERROR message if the NVRAM is not installed or is not operational as detected by the NVRAM test.

The current configuration is comprised of a list of storable parameters illustrated in the &V command. These settings are restored to the active configuration upon receiving an Zn command or at power up (see &Yn command).

&W0   Store the current configuration as profile 0.

&W1   Store the current configuration as profile 1.

Result Codes:

OK   n = 0 or 1.

ERROR   Otherwise.

10.3.16   & Xn - Select Synchronous Clock Source

Selects the source of the transmit clock for the synchronous mode of operation. The parameter value, if valid, is written to S27 bits 4 and 5.

In asynchronous mode, the transmit and receive clocks are turned OFF. In synchronous mode, the clocks are turned ON with the frequency of 1200 Hz or faster corresponding to the speed that is selected for modem operation.

&X0   Selects internal timing. The modem generates the transmit clock signal and applies it to the TXCLK output at the serial interface.

&X1   Selects external timing. The local DTE sources the transmit clock signal on the XTCLK input of the serial interface. The modem applies this clock to the TXCLK output at the serial interface.

&X2   Selects slave receive timing. The modem derives the transmit clock signal from the incoming carrier and applies it to the TXCLK output at the serial interface.

Result Codes:

OK   n = 0 to 2.

ERROR   Otherwise.

10.3.17   &Yn - Designate a Default Reset Profile

Selects which user profile will be used after a hard reset.

&Y0   The modem will use profile 0.

&Y1   The modem will use profile 1.

Result Codes:

OK   n = 0 to 1.

ERROR   If n > 1, or if NVRAM is not installed or is not operational.

10.3.18   &Zn=x - Store Telephone Number

The modem can store up to four telephone numbers and each telephone number dial string can contain up to 31 digits.

(Requires 256-byte NVRAM installed.)

&Zn=x n = Decimal number from 0 to 3 corresponding to the selected telephone number.

x = Dial string from 0 to 31 characters.

Result Codes:

OK   For n <= 3, and x <= 31 digits.

ERROR   If n > 3, x > 31 digits, or if NVRAM is not installed or is not operational.

10.4   AT+ Command Set

10.4.1   +A8E=a,b,c,d,e,f - V.8 and V.8bis Operation Controls

This command is defined for two conditions: as a parameter while the modem is on-hook, and as an action command while the modem is off-hook. If enabled, V.8 negotiation does not preclude simultaneous implementation of other negotiation means (e.g., V.8bis, V.18, V.32bis Annex A).

This command is a compound parameter if issued while the modem is on-hook, used to precondition V.8 and V.8bis originating and answering operation. It is issued by the DTE before the Dial (D) or Answer (A) command, regardless of the state of the +FCLASS parameter.

This command is an action command if issued while the modem is off-hook, to (re)start V.8 or V.8bis negotiation. For example, if initial V.8 negotiation failed, but subsequent T.30 negotiation indicated V.8 capability, this command may be used to initiate V.8 negotiation.

Command: +A8E=a,b,c[,d][,e][,f]

a   Decimal number which enables/disables issuance of +A8 x indications during modem-controlled V.8 origination negotiation.

1   Enable DCE-controlled V.8 origination negotiation without +A8x indications. (Default.)

6   Enable DCE-controlled V.8 origination negotiation with +A8x indications.

b   Decimal number which enables/disables issuance of +A8 x indications during modem-controlled V.8 answer negotiation.

1   Enable DCE-controlled V.8 answer negotiation without +A8x indications. (Default.)

5   Enable DCE-controlled V.8 answer negotiation with +A8x indications.

C   Set the V.8 CI signal call function to the hexadecimal octet XY.

0   (Default.)

21

C1

d   Decimal number which enables/disables V.8bis negotiation.

0   Disable V.8bis negotiation.

1   Enable V.8bis negotiation. (Default.)

e   "<string of values>". Applicable only for <v8a>=5. Not supported.

f   "<string of values>". Applicable only for <v8a>=5. Not supported.

Default values: 1,1,00,1,0,0

The ATD and ATA commands behave as specified in V.250, and +A8n indications are not generated by the modem.

For subparameter values <v8o>=6 and <v8a>=5, the +A8I indications are issued during the course of the V.8 session to notify the DTE when the relevant V.8 signals are received.

Reporting Current or Selected Values

Command: +A8E?

Response: +A8E: a,b,c[,d][,e][,f]

Example: +A8E: 1,1,00,1,0,0 For the defaults

Reporting Supported Range of Parameter Values

Command: +A8E=?

Response: +A8E: (a range),(b range), (maximum size of c in octets), (d range)

Example: +A8E: (1,6),(1,5),(0,21,C1),(0,1)

10.4.2   +A8I:x,y - CI Signal Indication

This indication is issued by an answering modem, if +A8E,<v8a> ≠ 0, to indicate detection of a V.8 CI signal, and report the recovered Call Function octet(s).

Indication: +A8I: x,y

x   A hexadecimal code octet representation of those Call Function octet(s). +A8I:0 indicates that the modem timed out waiting for CI.

Example: +A8I:0   The modem timed out waiting for CI.

+A8I:X   YYY

10.4.3   +DS = a,b,c,d - Data Compression

This extended-format compound parameter controls the V.42bis data compression function if provided in the modem. It accepts four numeric subparameters:

Command: +DS=[a[,b[,c[,d]]]]

a   Specifies the desired direction(s) of operation of the data compression function; from the DTE point of view.

0   Negotiated; no compression (V.42bis P0=0).

3   Both directions, accept any direction (V.42bis P0=11). (Default.)

b   Specifies whether or not the modem should continue to operate if the desired result is not obtained.

0   Do not disconnect if V.42bis is not negotiated by the remote modem as specified in "a".

c   Specifies the maximum number of dictionary entries (2048 entries) which should be negotiated (may be used by the DTE to limit the codeword size transmitted, based on its knowledge of the nature of the data to be transmitted).

d   Specifies the maximum string length (32 bytes) to be negotiated (V.42bis P2).

Reporting Current or Selected Values

Command: +DS?

Response: +DS: a,b,c,d

Example: +DS: 3,0,2048,32 for the defaults and 2048 entry max dictionary.

Reporting Supported Range of Parameter Values

Command: +DS=?

Response: +DS: (a range),(b range),(c range),(d range)

Example: +DS: (0,3),(0),(2048),(32)

10.4.4   +DR=n - Data Compression Reporting

This extended-format numeric parameter controls whether or not the extended-format "+DR: " intermediate result code is transmitted from the modem to the DTE.

S95 bit 5 is reset to 0 for +DR=0 and is set to a 1 for +DR=1. The more recent setting of +DR or S95 bit 5, and the W command setting, determines the actual data compression result code reporting (see S95 Parameter and W Command).

Command: +DR=[n]

n   Decimal number corresponding to the selected option:

0   Data compression reporting disabled (no +DR result code transmitted).

1   Data compression reporting enabled (+DR result code transmitted). (Default.)

Reporting Current or Selected Values

Command: +DR?

Response: +DR: n

Example: +DR: 1 For the default setting.

Reporting Supported Range of Parameter Values

Command: +DR=?

Response: +DR: (n range)

Example: +DR: (0,1)

+DR: n Intermediate Result Code

The +DR: n reported represents the current (negotiated or renegotiated) modem-modem data compression type. If enabled, the intermediate result code is transmitted at the point after error control negotiation (handshaking) at which the modem has determined which data compression technique will be used (if any) and the direction of operation. The +DR intermediate result code, if enabled, is issued after the Error Control Report (+ER) and before the final result code (e.g., CONNECT).

Result Code: +DR: n

n   An alphanumeric code corresponding to the selected option:

NONE   Data compression is not in use.

V42B   V.42bis is in use in both directions.

ALT   MNP 5 compression.

Example: +DR: V42B

10.4.5   +EB=x,y,z - Break Handling in Error Control Operation

This extended-format compound parameter controls the break handling in V.42 operation. It accepts three numeric subparameters:

Command: +EB=[x[,y[,z]]]

x   Decimal number 0 specifying that break is to be ignored, i.e., not signaled to remote DCE.

y   Decimal number 0 specifying that any transmitted V.42 L-SIGNAL will not indicate break signal length.

Z   Decimal number 0 specifying that break is not delivered to the DTE.

Reporting Current or Selected Values

Command: +EB?

Response: +EB: x,y,z<CR>

Example: +EB: 0,0,0 For default settings.

Reporting Supported Range of Parameter Values

Command: +EB=?

Response: +EB: (x range),(y range), (z range)

Example: +EB: (0),(0),(0)

10.4.6   +EFCS=n - 32-bit Frame Check Sequence

This extended-format numeric parameter controls the use of the 16-bit or 32-bit frame check sequence (FCS) option in V.42.

Command: +EFCS=[n]

n   Decimal number 0 specifying the use of the 16-bit FCS specified in V.42.

Reporting Current or Selected Values

Command: +EFCS?

Response: +EFCS: n

Example: +EFCS: 0 For default setting.

Reporting Supported Range of Parameter Values

Command: +EFCS=?

Response: +EFCS: (n range)

Example: +EFCS: (0)

10.4.7   +ER=n - Error Control Reporting

This extended-format numeric parameter controls whether or not the extended-format "+ER: " intermediate result code is transmitted from the modem to the DTE.

S95 bit 3 is reset to 0 for +ER=0 and is set to a 1 for +ER=1. The more recent setting of +ER or S95 bit 3, and the W command setting, determines the actual error control result code reporting (see S95 Parameter and W Command).

Command: +ER=[n]

n   A decimal number corresponding to the selected error control option:

0   Error control reporting disabled (no +ER intermediate result code transmitted). (Default.)

1   Error control reporting enabled (+ER intermediate result code transmitted).

Reporting Current or Selected Values

Command: +ER?

Response: +ER: n

Example: +ER: 0 for the default setting

Reporting Supported Range of Parameter Values

Command: +ER=?

Response: +ER: (n range)

Example: +ER: (0,1)

+ER: n

The +ER: n reported represents the current (negotiated or renegotiated) modem-modem error control type. If enabled, the intermediate result code is transmitted at the point during error control negotiation (handshaking) at which the modem has determined which error control protocol will be used (if any), before the final result code (e.g., CONNECT) is transmitted. The format of this result code is:

The +ER intermediate result code, if enabled, is issued after the Modulation report (+MCR and +MRR) and before the Data Compression Report (+DR).

Command: +ER: n

n   An alphanumeric code corresponding to the selected protocol.

NONE   Error control is not in use.

LAPM   V.42 LAPM protocol is in use.

ALT   MNP is in use.

Example: +ER: LAPM

10.4.8   +ES=x,y,z - Error Control and Synchronous Mode Selection

This extended-format command specifies the initial requested mode of operation when the modem is operating as the originator, optionally specifies the acceptable fallback mode of operation when the

modem is operating as the originator, and optionally specifies the acceptable fallback mode of operation when the modem is operating as the answerer. It accepts three numeric subparameters:

Command: +ES=[x[,y[,z]]]

x   Decimal number which specifies the initial requested mode of operation when the modem is operating as the originator. The options are:

    0   Initiate call with Direct Mode.

    1   Initiate call with Normal Mode (also referred to as Buffered Mode) only.

    2   Initiate V.42 without Detection Phase. If V.8 is in use, disable V.42 Detection Phase.

    3   Initiate V.42 with Detection Phase. (Default.)

    4   Initiate MNP.

    6   Initiate V.80 Synchronous Access Mode when connection is completed, and Data State is entered. (See +ESA and +ITF commands.)

    7   Initiate Frame Tunneling Mode when connection is complete, and Data Mode is entered.

y   Decimal number which specifies the acceptable fallback mode of operation when the modem is operating as the originator.

    0   LAPM, MNP, or Normal Mode error control optional. (Default.)

    1   LAPM, MNP, or Direct Mode error control optional.

    2   LAPM or MNP error control required; disconnect if error control is not established.

    3   LAPM error control required; disconnect if error control is not established.

    4   MNP error control required; disconnect if error control is not established.

z   Decimal number which specifies the acceptable fallback mode of operation when the modem is operating as the answerer or specifies V.80 Synchronous Access Mode.

    0   Direct Mode.

    1   Error control disabled, use Normal Mode.

    2   LAPM, MNP, or Normal Mode error control optional. (Default.)

    3   LAPM, MNP, or Direct Mode error control optional.

    4   LAPM or MNP error control required; disconnect if error control is not established.

    5   LAPM error control required; disconnect if error control is not established.

    6   MNP error control required; disconnect if error control is not established.

    8   Initiate V.80 Synchronous Access Mode when connection is completed, and Data State is entered (see +ESA and +ITF commands).

    9   Initiate Frame Tunneling Mode when connection is complete, and Data Mode is entered.

Examples:

+ES=6	Enable V.80 Synchronous Access Mode originator
+ES=,,8	Enable V.80 Synchronous Access Mode answerer
+ES=6,,8	Enable V.80 Synchronous Access Mode originator and answerer
+ES=3	Enable V.42 with Detection Phase originator. Disable V.80 Synchronous Access Mode originator.
+ES=,,2	Allow LAPM, MNP, or Normal Mode connection answerer. Disable V.80 Synchronous Access Mode answerer.
+ES=3,,2	Enable V.42 with Detection Phase originator, allow LAPM, MNP, or Normal Mode connection answer. Disable Synchronous Access Mode originator and answerer.

Reporting Current or Selected Values

Command:	+ES?
Response:	+ES: x,y,z
Example:	+ES: 3,0,2 For default settings.

+ES: 6,0,8   For V.80 Synchronous Access Mode originator and answerer.

Reporting Supported Range of Parameter Values

Command:	+ES=?
Response:	+ES: (x range),(y range), (z range)
Example:	+ES: (0-4,6,7),(0-4),(0-6,8,9)

10.4.9   +ESA=a,b,c,d,e,f,g,h - Configure Synchronous Access Submode

The operation of the Synchronous Access sub-Mode is configured by the +ESA parameter.

This extended-format compound parameter is used to control the manner of operation of the Synchronous Access Mode in the modem. It accepts six numeric subparameters:

Command: +ESA=[a[,b[,c[,d[,e[,f[,g[,h]]]]]]]]

a   Specifies the bit sequence transmitted by the modem when a transmit data buffer underrun condition occurs, while operating in Transparent sub-Mode. The options are:

    0   In Transparent sub-Mode, modem transmits 8-bit SYN sequence on idle. Modem receiver does not hunt for synchronization sequence (default and fixed).

b   Specifies the bit sequence transmitted by the modem when a transmit data buffer underrun condition occurs immediately after a flag, while operating in Framed sub-Mode. The options are:

    0   In Framed sub-Mode, modem transmits HDLC flags on idle (default and fixed).

c   Specifies the actions undertaken by the modem when a transmit data buffer underrun or overrun condition occurs immediately after a non-flag octet, while operating in Framed sub-Mode.

0	In Framed sub-Mode, modem transmits abort on underrun in middle of frame (default).
1	In Framed sub-Mode, DCE transmits a flag on underrun in middle of frame, and notifies DTE of underrun or overrun.

d Specifies whether or not, in V.34 half-duplex operation, additional procedures besides those specified in § 12/V.34 shall be performed by the modem when switching from primary channel to secondary channel operation, and vice versa. This subparameter should not be commanded.

e Specifies the CRC polynomial used while operating in Framed sub-Mode. The options are:

0	CRC generation and checking disabled (default).
1	In Framed sub-Mode, the 16-bit CRC is generated by the modem in the transmit direction, and checked by the modem in the receive direction.

f Specifies if Non Return to Zero Inverted (NRZI) encoding is to be used by the modem for transmit and receive data. The options are:

0	NZRI encoding and decoding disabled (default and fixed).

g, h Specifies the octet value(s) to be used while performing character-oriented framing, where g is to be commanded to 255 (FFh); h is not to be commanded.

Reporting Selected Options

The modem reports the selected options in response to the following command:

Command: +ESA?

Response: +ESA:a,b,c,d,e,f,g,h

Example: +ESA: 0,0,0, ,0,0,255, for the defaults.

Reporting Supported Options

The modem reports the supported options in response to the following command:

Command: +ESA=?

Response: +ESA: (list of supported a values), (list of supported b values),

(list of supported c values), (list of supported d values),

(list of supported e values), (list of supported f values),

(list of supported g values), (list of supported h values)

Example: +ESA: (0),(0),(0-1), ,(0-1),(0),(255),

10.4.10 +ESR=n - Selective Repeat

This extended-format numeric parameter controls the use of the selective repeat (SREJ) option in V.42.

Command: +ESR=[n] Decimal number 0 specifying that SREJ is not used.

Example: +ESR: (0) For default settings.

10.4.11   +ETBM=x,y,z - Call Termination Buffer Management

This extended-format compound parameter controls the handling of data remaining in modem buffers upon call termination. It accepts three numeric subparameters:

Command: +ETBM=[x[,y[,z]]]

x   Decimal number 0 specifying that disconnect will occur immediately and all buffered transmit data will be discarded when the local DTE requests call disconnection.

y   Decimal number 0 specifying that disconnect will occur immediately and all buffered receive data will be discarded when the local DTE requests call disconnection.

Z   Decimal number 0 specifying that the modem will not attempt to deliver the buffered data before abandoning the attempt and discarding remaining data.

Reporting Current or Selected Values

Command: +ETBM?

Response: +ETBM: x,y,z

Example: +ETBM: 0,0,0

Reporting Supported Range of Parameter Values

Command: +ETBM=?

Response: +ETBM: (x range),(y range), (y range)

Example: +ETBM: (0),(0),(0)

10.4.12   +FCLASS=n - Select Active Service Class

This command selects the active service class.

+FCLASS=0   Select Data Mode (see Section 3) (Default.)

+FCLASS=1   Select Facsimile Class 1 Mode (see Section 4)

+FCLASS=1.0 Select Facsimile Class 1.0 Mode (see Section 4)

+FCLASS=2   Select Facsimile Class 2 Mode (see Section 5)

+FCLASS=8   Select Voice Mode (see Section 6)

+FCLASS=80   Select VoiceView Mode (see Section 6)

Result Codes:

OK   For n = 0, 1, 1.0, 2, 8, and 80.

ERROR   Otherwise.

Reporting Current or Selected Values

Command: +FCLASS?

Response: +FCLASS: n

Example: +FCLASS: 0 For the default setting.

Reporting Supported Range of Parameter Values

Command: +FCLASS=?

Response: +FCLASS: (n range)

Example: +FCLASS: (0,1,1.0,2,8,80)

10.4.13   +GCAP - Request Complete Capabilities List

This extended-format command causes the modem to transmit one or more lines of information text listing additional capabilities command +<name>s , which is intended to permit the user to identify the overall capabilities of the modem. In particular, if the modem implements a particular modem control standard that uses Extended Syntax Commands, and if that modem control standard includes command(s) that indicate general capabilities, the +<names>(s) of those commands will be reported to the modem in response to a +GCAP command.

Command: +GCAP

Example Responses: +GCAP: +FCLASS, +MS, +ES, +DS,   for a data modem that

supports all capabilities listed.

Where:

+FCLASS T.class1, +F (Class 1 Facsimile modem Control)

+MS +M commands (Modulation Control: +MS and +MR commands)

+ES +E commands (Error Control: +ES, +EB, +ER, +EFCS, +ETBM)

+DS +D commands (Data Compression: +DS and +DR)

10.4.14   +GCI=nn - Country of Installation

This extended syntax command selects and indicates the country of installation for the modem. This parameter selects the settings for any operational parameters that need to be adjusted for national regulations or telephone networks.

+GCI=nn

Where nn is the 8-bit country code from Annex A of T.35. The value is the hexadecimal equivalent of the T.35 code, with bit 8 treated as the most significant bit and bit 1 treated as the least significant bit.

The supported countries are:

Country	Code
Australia:	09h
Austria:	0Ah
Belgium:	0Fh
Bulgaria:	1Bh

Canada:	20h
China:	26h
Czech and	
Slovak Federal Republic:	2Eh
Denmark:	31h
Finland:	3Ch
France:	3Dh
Germany:	42h
Greece:	46h
Hong Kong:	50h
Hungary:	51h
India:	53h
Ireland:	57h
Israel:	58h
Italy:	59h
Japan:	00h
Korea:	61h
Luxembourg:	69h
Mexico:	73h
Netherlands:	7Bh
New Zealand:	7Eh
Norway:	82h
Philippines:	89h
Poland:	8Ah
Portugal:	8Bh
Russia:	B8h
Singapore:	9Ch
Spain:	A0h
Sweden:	A5h
Switzerland:	A6h
Taiwan:	FEh
United Kingdom:	B4h
United States:	B5h

Reporting Current or Selected Values

Command: +GCI?

Response: +GCI: nn

Example: +GCI: 3D indicates that the modem is set for France.

Reporting Supported Range of Parameter Values

Command: +GCI=?

Response: +GCI: (nn[,nn[,nn].......]]

Example: +GCI: (20,73,B5) The modem can be set for Canada, Mexico or the United States.

10.4.15   +GMI - Request Manufacturer Identification

This command causes the modem to report the modem product manufacturer.

Command: +GMI

Typical Response: +GMI: ROCKWELL

OK

10.4.16   +GMM - Request Model Identification

This command causes the modem to report the modem product.

Command: +GMM

Typical Response: +GMM: V90

10.4.17   +GMR - Request Revision Identification

This command causes the modem to report the modem version, revision level or date. This is the same as the I3 command.

Command: +GMR

Typical Response: +GMR: V3.001-V90_2M_DLS

OK

10.4.18   +IFC=n - DTE-Modem Local Flow Control

This extended-format compound parameter controls the operation of local flow control between the DTE and the modem during the data state when V.42 error control is used, or when fallback to non-error control mode is specified to include buffering and flow control. It accepts two numeric subparameters.

Command: +IFC=[m[,n]]

m =   Specifies the method to be used by the DTE to control the flow of received data from the modem.

       0   None.

       1   XON/XOFF on transmitted data (XON/XOFF on transmit data); do not pass XON/XOFF characters to the remote modem.

| | 2 | Circuit 133 (Ready for Receiving). (Default.) |

n = Specifies the method to be used by the modem to control the flow of transmitted data from the DTE.

    0   None.

    1   XON/XOFF on received data.

    2   CTS/RTS. (Default.)

Reporting Current or Selected Values

Command: +IFC?

Response: +IFC: m,n

Example: +IFC: 2,2 for the defaults.

Reporting Supported Range of Parameter Values

Command: +IFC=?

Response: +IFC: (m range),(n range)

Example: +IFC: (0-2),(0-2)

10.4.19   +ILRR=n - DTE-Modem Local Rate Reporting

This extended-format numeric parameter controls whether or not the extended-format +ILRR:<rate> information text is transmitted from the modem to the DTE.

Command: +ILRR=n

    0   Disables reporting of local port rate (+ILRR: is not transmitted). (Default.)

    1   Enables reporting of local port rate (+ILRR: is transmitted).

Reporting Current or Selected Values

Command: +ILRR?

Response: +ILRR: n

Example: +ILRR: 0 For the default setting

Reporting Supported Range of Parameter Values

Command: +ILRR=?

Response: +ILRR: (n range)

Example: +ILRR: (0,1)

10.4.20   +ILRR:m,n - DTE-Modem Local Reported Rate

The reported rate m, represents the current (negotiated or renegotiated) DTE-modem rate. If enabled, the intermediate result code is transmitted after any modulation, error control or data compression reports are transmitted, and before any final result code (e.g., CONNECT) is transmitted. The rate m, is applied after the final result code is transmitted.

The DTE-modem port rate will change only if neither buffered mode nor error controlled means are enabled (+ES=x,0) and if the negotiated carrier rate (+MRR) does not match the current DTE-modem port rate (autodetected from the previous command line).

Command: +ILRR: m[,n]

Defined Values

m   Decimal value representing the current (negotiated or renegotiated) DTE-modem rate:

        0, 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, or 230400

n   Optional decimal value reporting the RXD rate, if it is different from the TXD rate:

        0, 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, or 230400

Example: +ILRR: 19200

10.4.21   + IPR=n - Fixed DTE Rate

This numeric extended-format parameter specifies the data rate at which the modem will accept commands during online operation. It may be used to select operation at rates at which the modem is not capable of automatically detecting the data rate being used by the DTE. Specifying a value of 0 disables the function and allows operation only at rates automatically detectable by the modem. The specified rate takes effect following the issuance of any result code(s) associated with the current command line.

The <rate> specified does not apply in OnLine Data State if Normal Mode (Direct Mode) of operation is selected.

Command: +IPR=n

Where n specifies the DTE-modem interface operation rate in bits/s. The available rates are:

        0, 300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, or 115200

If unspecified or set to 0, automatic detection is selected and the character format is also forced to autodetect, +ICF=0.

If the rate specified is not supported by the modem, an ERROR result code will be returned.

Reporting Current or Selected Values

Command: +IPR?

Response: +IPR: n

Example 1: +IPR: 0 for automatic rate detection.

Example 2: +IPR: 115200 for 115200 bps.

Reporting Supported Range of Parameter Values

Command: +IPR=?

Response: +IPR (n range)

Example: +IPR: (0,300,1200,2400,4800,9600,19200,38400,57600,115200)

10.4.22   +ITF=a,b,c - Transmit Flow Control Thresholds

The +ITF command determines the flow control thresholds used by the modem for transmit data from the DTE.

This optional compound parameter allows the DTE to determine the input buffer size in the modem for data on circuit 103 (transmit data) from the DTE, to control the thresholds used for flow control of such data, and to control how often the modem reports to the DTE the number of octets in this buffer. The DTE can adjust its own thresholds for flow control of data on circuit 104 (received data) from the modem.

Command: +ITF=[a[,b[,c]]]

a   Determines the threshold, in octets, above which the modem will generate a flow off signal. Applicable in Synchronous Access and Frame Tunneling modes. Default <off> value is 255.

         For the a and b subparameters, the input buffer is assumed to reside between the modem's V.24 interface and the Synchronous Access protocol layer; i.e., the buffer count includes all octets, including EM codes, received from the DTE, with the exception of DC1 and DC3 if these are used to signal <modem-by-DTE> flow control.

         The modem returns the ERROR result code if the DTE specifies that the <off> subparameter be set to a value less than or equal to the <on> subparameter; in this case, the current parameter value settings are not modified.

b   Determines the threshold, in octets, below which the modem will generate a flow on signal. Applicable in Synchronous Access and Frame Tunneling modes. Default <on> value is 64.

c   Not supported. A fixed value of zero is used and reported.

Reporting Selected Options:

The modem sends a string of information text to the DTE consisting of selected options in response to the following command:

Command: +ITF?

Response: +ITF: a,b,c

Example: +ITF: 255,64,0 Default values

Reporting Supported Options:

The modem sends a string of information text to the DTE consisting of supported options in response to the following command:

Command: +ITF=?

Response: +ITF: (list of supported a values),(list of supported b values),(list of supported c values)

Example: +ITF: (0-255),(0-255),(0)

The maximum reported "a" value is the input transmit data buffer level at which the modem signals a transmit data overrun indication to the DTE.

10.4.23   +MR=n - Modulation Reporting Control

This extended-format numeric parameter controls whether or not the extended-format +MCR:<carrier> and +MRR:<rate> intermediate result codes are transmitted from the modem to the DTE. If enabled, +MCR:<carrier> and +MRR:<rate> intermediate result codes represent the current (negotiated or renegotiated) modulation <carrier> and <rate> that are transmitted at the point during connect negotiation (handshaking) at which the modem has determined which modulation and rate will be used, i.e., before any Error Control or Data Compression reports are transmitted, and before any final result code (e.g., CONNECT) is transmitted.

S95 bit 2 is reset to 0 for +MR=0 and is set to a 1 for +MR=1 or +MR=2. The more recent setting of +MR or S95 bit 2, and the W command setting, determines modulation result code reporting (see S95 Parameter and W Command).

Command: +MR=[n]

n   A decimal number corresponding to the selected option:

   0   Disables reporting of modulation connection (+MCR: and +MRR: are not transmitted). (Default.)

   1   Enables reporting of modulation connection (+MCR: and +MRR: are transmitted with tx rate, rx rate).

   2   Enables reporting of modulation connection (+MCR: and +MRR: are transmitted with rx rate only).

Reporting Current or Selected Values:

Command: +MR?

Response: +MR: n

Example: +MR: 0 for default setting

Reporting Supported Range of Parameter Values

Command: +MR=?

Response: +MR: (n range)

Example: +MR: (0-2)

+MCR: xxxx

Report Syntax

Response: +MCR: xxxx

B103   Bell 103

B212   Bell 212

V21   V.21

V22   V.22

V22B   V.22bis

V23C	V.23
V32	V.32
V32B	V.32bis
V34	V.34
V90	V.90
K56	K56flex

+MRR: m,n

Report Syntax

Response: +MRR: m,n

m   Decimal transmit rate in bits/s.

n   Decimal receive rate in bits/s.

Example: MRR: 28800, 48000

10.4.24   +MS - Select Modulation

This extended-format compound parameter controls the manner of operation of the modulation capabilities in the modem. It accepts six subparameters:

Command

+MS=[<carrier>[,<automode>[,<min_tx_rate>[,<max_tx_rate>[,<min_rx_rate>[,<max_rx_rate>]]]]]]

Where: Possible <carrier>, <min_tx_rate>, <max_tx_rate>, <min_rx_rate>, and <max_rx_rate> values are listed in the following table. (see definitions below).

Modulation	<carrier>	Possible (<min_rx_rate>, <min_rx_rate>, (<min_tx_rate>), and <max_tx_rate>) Rates (bps)
Bell 103	B103	300
Bell 212	B212	1200 Rx/75 Tx or 75 Rx/1200 Tx
V.21	V21	300
V.22	V22	1200
V.22 bis	V22B	2400 or 1200
V.23	V23C	1200
V.32	V32	9600 or 4800
V.32 bis	V32B	14400, 12000, 9600, 7200, or 4800
V.34	V34	33600, 31200, 28800, 26400, 24000, 21600, 19200, 16800, 14400, 12000, 9600, 7200, 4800, or 2400
V.90	V90	56000, 54667, 53333, 52000, 50667, 49333, 48000, 46667, 45333, 42667, 41333, 40000, 38667, 37333, 36000, 34667, 33333, 32000, 30667, 29333, 28000
K56flex	K56	56000, 54000, 52000, 50000, 48000, 46000, 44000, 42000, 40000, 38000, 36000, 34000, 32000

Defined Values

<carrier>   A string which specifies the preferred modem carrier to use in originating or answering a connection. <carrier> values are strings of up to eight characters, consisting only of numeric digits and upper case letters. <carrier> values for ITU standard modulations take the form: <letter><1-4 digits><other letters as needed>.

<automode>   A numeric value which enables or disables automatic modulation negotiation (e.g., ITU-T V.32 bis Annex A or V.8).

                   0 = Automode disabled.

                   1 = Automode enabled. (Default.)

<min_rx_rate> and

<max_rx_rate>   Numeric values which specify the lowest (<min_rx_rate>) and highest (<max_rx_rate>) rate at which the modem may establish a receive connection. May be used to condition distinct limits for the receive direction as distinct from the transmit direction. Values for this sub parameter are decimal encoded; in units of bit/s. Actual values will be limited to possible values corresponding to the entered <carrier> and fallback <carrier> as determined during operation. (Default = lowest (<min_rx_rate>) and highest (<max_rx_rate>) rate supported by the selected carrier.)

<min_tx_rate> and

<max_tx_rate>   Numeric values which specify the lowest (<min_tx_rate>) and highest (<max_tx_rate>) rate at which the modem may establish a transmit connection. Non-zero values for this sub parameter are decimal encoded; in units of bit/s. Actual values will be limited to possible values corresponding to the entered <carrier> and fallback <carrier> as determined during operation. (Default = lowest (<min_tx_rate>) and highest (<max_tx_rate>) rate supported by the selected carrier.)

Reporting Current or Selected Values

Command: +MS?

Response: +MS:<carrier>,<automode>,<min_tx_rate>,<max_tx_rate>,

<min_rx_rate>,<max_rx_rate>

Note: The current active settings are reported under control of the +MR parameter.

Example: +MS: K56, 1,300,33600,300,56000 For default values. This example allows maximum system flexibility to determine optimal receive and transmit rates during operation.

Reporting Supported Range of Parameter Values

Command: +MS=?

Response: +MS: (<carrier>range),(<automode>range),(<min_tx_rate>range),

(<max_tx_rate> range),(<min_rx_rate> range), (<max_rx_rate> range)

Example: +MS: (B103,B212,V21,V22,V22B,V23C,V32,V32B,V34,K56,V90),

(0,1),(300-33600),(300-33600),(300-56000),(300-56000)

Result Code:

OK   Valid sub parameter string

ERROR   Otherwise.

10.4.25   +VCID=n - Caller ID (CID)

This command controls the reporting and presentation of data associated with the Caller ID services in the Incoming Call Line ID (ICLID) data format.

+VCID=0   Disable Caller ID reporting. (Default).

+VCID=1   Enables Caller ID with formatted presentation to the DTE. The modem will present the data items in a <Tag><Value> pair format. The expected pairs are date, time, name, and caller code (telephone number), +VCID=2 Enables Caller ID with unformatted presentation to the DTE.

Reporting Current or Selected Values

Command: +VCID?

Response: +VCID: n

Example: +VCID: 0 For the default setting.

Reporting Supported Range of Parameter Values

Command: +VCID=?

Response: +VCID: (n range)

Example: +VCID: (0-2)

10.5   AT- Command Set

10.5.1   -Kn – MNP 10 Extended Services

Enables or disables conversion of a V.42 LAPM connection to an MNP 10 connection. The parameter value, if valid, is written to S40 bits 0 and 1.

-K0   Disables V.42 LAPM to MNP 10 conversion. (Default.)

-K1   Enables V.42 LAPM to MNP 10 conversion.

-K2   Enables V.42 LAPM to MNP 10 conversion; inhibits MNP Extended Services initiation during V.42 LAPM answer mode detection phase.

Result Codes:

OK   n = 0 to 2.

ERROR   Otherwise.

10.5.2   -SMS=n - Select Mode

Selects Data mode, AudioSpan (analog simultaneous voice and data), or DSVD (digital simultaneous voice and data) or enables automatic mode selection. The x parameter selects the mode.

Command: -SMS<mode>

Defined Values

n   Decimal number corresponding to the selected mode or automatic mode select enable.

       0   Data mode (Default)

       1   DSVD mode (a modem not supporting DSVD will respond with ERROR)

       2   AudioSpan mode (a modem not supporting AudioSpan will respond with ERROR).

       3   Automatic mode select (DSVD/AudioSpan/Data)

NOTES:

AudioSpan and DSVD are two technologies that allow simultaneous voice and data operation using a Rockwell modem connected to a telephone line. AudioSpan and DSVD implementations differ in the manner that voice and modem data are combined. Voice and data channels are combined in the analog domain for AudioSpan and in the digital domain for DSVD.

Establishing a AudioSpan or DSVD connection is analogous to establishing a regular data modem connection. Initiate the call using normal dialing (ATD) and answering (ATA) procedures. The modem can switch from a regular phone conversation into AudioSpan or DSVD mode and back to phone conversation. A handset, headset, or microphone/speaker can be used for voice communication during AudioSpan or DSVD mode.

AudioSpan operates in normal (non-error corrected) or error-corrected/compression mode (MNP 5 or V.42 bis depending on the error correction settings of the modems). The DTE rate must be equal to or greater than the anticipated DCE connection speed. In general, DTE speed of 38400 bps or higher should be used.

DSVD requires a V.34 mode connection.

AudioSpan audio quality is dependent upon telephone line quality. Higher quality telephone lines provide better audio quality than impaired telephone lines.

Reporting Selected Options:

The modem reports the selected options in response to the following command:

Command: -SMS?

Response: n

Example: 1

Reporting Supported Options:

The modem reports the supported options in response to the following command:

Command: -SMS=?

Response: (list of n values)

Example: (0,1,2,3)

10.5.3   –STE=n - Set Telephony Extension

This command enables/disables Line-In-Use and Extension Pickup/Remote Hangup Detection.

Command: -STE=<value>

n   Decimal number corresponding to the selected option.

> 0   Disables Line-In-Use and Extension Pickup/Remote Hangup Detection. (Default.)
>
> 3   Enables Line-In-Use and disables Extension Pickup/Remote Hangup Detection.
>
> 4   Disables Line-In-Use and enables Extension Pickup/Remote Hangup Detection.
>
> 5   Enables both Line-In-Use and Extension Pickup/Remote Hangup Detection.

Result Codes

OK   n = 0-3.

ERROR   Otherwise.

10.6   AT\ Command Set

10.6.1   \Bn - Transmit Break to Remote

In non-error correction mode, the modem will transmit a break signal to the remote modem with a length in multiples of 100 ms according to parameter specified. If a number in excess of 9 is entered, 9 is used. The command works in conjunction with the \K command.

In error correction mode, the modem will signal a break through the active error correction protocol, giving no indication of the length.

Command: \Bn

n   Decimal number corresponding to the selected option.

> 1-9   Break length in 100 ms units. (Default = 3.) (Non-error corrected mode only.)

Result Codes

OK   If connected in data modem mode.

NO CARRIER If not connected or connected in fax modem mode.

Note:	When the modem receives a break from the remote modem, break is passed to the DTE as follows: In non-error correction mode direct, the break length is passed; in non-error correction mode normal and in error correction mode, a 300 ms break is passed.

10.6.2   \Kn - Break Control

Controls the response of the modem to a break received from the DTE or the remote modem or the \B command. The parameter value, if valid, is written to S40 bits 3, 4, and 5.

Command: \Kn

n   Decimal number corresponding to the selected option.

The response is different in three separate states.

The **first state** is where the modem receives a break from the DTE when the modem is operating in data transfer mode:

> 0   Enter on-line command mode, no break sent to the remote modem.
>
> 1   Clear data buffers and send break to remote modem.
>
> 2   Same as 0.

3   Send break to remote modem immediately.

4   Same as 0.

5   Send break to remote modem in sequence with transmitted data. (Default.)

The **second case** is where the modem is in the on-line command state (waiting for AT commands) during a data connection, and the \B is received in order to send a break to the remote modem:

0   Clear data buffers and send break to remote modem.

1   Clear data buffers and send break to remote modem. (Same as 0.)

2   Send break to remote modem immediately.

3   Send break to remote modem immediately. (Same as 2.)

4   Send break to remote modem in sequence with data.

5   Send break to remote modem in sequence with data. (Same as 4.) (Default.)

The **third case** is where a break is received from a remote modem during a non-error corrected connection:

0   Clears data buffers and sends break to the DTE.

1   Clears data buffers and sends break to the DTE. (Same as 0.)

2   Send a break immediately to DTE.

3   Send a break immediately to DTE. (Same as 2.)

4   Send a break in sequence with received data to DTE.

5   Send a break in sequence with received data to DTE. (Same as 4.) (Default.)

Result Codes

OK   0 to 5.

ERROR   Otherwise.

10.6.3   \Nn - Operating Mode

This command controls the preferred error correcting mode to be negotiated in a subsequent data connection. This command is affected by the OEM firmware configuration.

Command: \Nn

n   Decimal number which corresponds to the selected mode.

0   Selects normal speed buffered mode (disables error-correction mode). (Forces &Q6.)

1   Serial interface selected - Selects direct mode and is equivalent to &M0, &Q0 mode of operation. (Forces &Q0.)

       Parallel interface selected - Same as \N0.

2   Selects reliable (error-correction) mode. The modem will first attempt a LAPM connection and then an MNP connection. Failure to make a reliable connection results in the modem hanging up. (Forces &Q5, S36=4, and S48=7.)

3   Selects auto reliable mode. This operates the same as \N2 except failure to make a reliable connection results in the modem falling back to the speed buffered normal mode. (Forces &Q5, S36=7, and S48=7.)

4   Selects LAPM error-correction mode. Failure to make an LAPM error-correction connection results in the modem hanging up. (Forces &Q5 and S48=0.) Note: The -K1 command can override the \N4 command.

5   Selects MNP error-correction mode. Failure to make an MNP error-correction connection results in the modem hanging up. (Forces &Q5, S36=4, and S48=128.)

Result Codes

OK   n = 0 to 5.

ERROR   Otherwise.

10.6.4   *\Vn - Single Line Connect Message Enable*

This command enables or disables the single line connect message format as follows:

Command: \Vn

n   Decimal number corresponding to the selected option.

0   Connect messages are controlled by the command settings X, W, and S95.

1   Connect messages are displayed in the single line format described below subject to the command settings V (Verbose) and Q (Quiet). In Non-Verbose mode (V0), single line connect messages are disabled and a single numeric result code is generated for CONNECT DTE.

When single line connect messages are enabled, there are no CARRIER, PROTOCOL (+ER:), or COMPRESSION (+DR:) messages apart from the fields described below.

The single line connect message format is:

CONNECT <DTE Speed></Modulation></Protocol></Compression></Line Speed>/<Voice and Data>

where:

<DTE Speed> =   DTE speed, e.g., 57600.

Modulation =   "V90" for V.90 modulation.

                         "K56" for K56flex modulation.

                         "V34" for V.34 modulation.

                         "V32" for V.32 or V.32bis modulation.

                         NOTE: Modulation is omitted for all other modulations.

Protocol =   "NONE" for no protocol.

                         "ALT" for Microcom Network Protocol.

                         "LAPM" for LAP-M protocol.

Compression =   "ALT" for Microcom MNP5 compression.

                         "V42B" for V.42bis compression.

NOTE: Compression is omitted if protocol is NONE.

Line Speed =	Asymmetric rates are displayed as /rate:TX/rate:RX, e.g., /1200 TX/75 RX.
	Symmetric rates are displayed as a single DCE rate, e.g., 14400.
Voice and Data =	Blank for Data mode only.
	"SVD" for AudioSpan analog simultaneous audio/voice and data.
	"DSVD" for digital simultaneous voice and data
	"V70" for G.729A digital simultaneous voice and data.

10.7   AT% Command Set

10.7.1   %7 - Plug and Play Serial Number

Sets and stores eight serial numbers in hex format used for serial Plug and Play and for ISA Plug and Play which use the Rockwell 11596 Plug and Play device. Applicable to Desktop configuration only.

Command: %7<8 hex numbers><same 8 hex numbers>

Example: %7<8 hex numbers><same 8 hex numbers>

Result Codes:

OK   <8 hex numbers><same 8 hex numbers>

ERROR   Otherwise

To display the stored serial number, issue AT"?<cr>.

10.7.2   %8 - Plug and Play Vendor ID and Product Number

Sets and stores Vendor ID and product number for serial Plug and Play and for ISA Plug and Play which use the Rockwell 11596 Plug and Play device. Applicable to Desktop configuration only.

Command: &8<3 ASCII characters><4 hex numbers><same 3 ASCII characters><same 4 hex numbers><cr>

Example: %8<3 ASCII characters><4 hex numbers><same 3 ASCII characters><same 4 hex numbers><cr>

Result Codes:

OK   <3 ASCII characters><4 hex numbers><same 3 ASCII characters><same 4 hex numbers>

ERROR   Otherwise

10.7.3   %Cn - Enable/Disable Data Compression

Enables or disables data compression negotiation. The modem can only perform data compression on an error corrected link.

The parameter value, if valid, is written to S41 bits 0 and 1.

Command: %Cn

n   Decimal number corresponding to the selected option.

0	Disables data compression. Resets S46 bit 1.
1	Enables MNP 5 data compression negotiation. Resets S46 bit 1.
2	Enables V.42 bis data compression. Sets S46 bit 1.
3	Enables both V.42 bis and MNP 5 data compression. Sets S46 bit 1. (Default.)

Result Codes:

| OK | n = 0, 1, 2, or 3. |
| ERROR | Otherwise. |

10.7.4   %En- Enable/Disable Line Quality Monitor and Auto-Retrain or Fallback/Fall Forward

Controls whether or not the modem will automatically monitor the line quality and request a retrain (%E1) or fall back when line quality is insufficient or fall forward when line quality is sufficient (%E2). The parameter value, if valid, is written to S41 bits 2 and 6.

If enabled, the modem attempts to retrain for a maximum of 30 seconds.

Command: %En

n   Decimal number corresponding to the selected option.

0	Disable line quality monitor and auto-retrain.
1	Enable line quality monitor and auto-retrain.
2	Enable line quality monitor and fallback/fall forward. (Default.)

Result Codes:

| OK | n = 0, 1, or 2. |
| ERROR | Otherwise. |

Fallback/Fall Forward

When %E2 is active, the modem monitors the line quality (EQM). When line quality is insufficient, the modem will initiate a rate renegotiation to a lower speed within the V.34/V.32 bis/V.32 (RC336) modulation speeds. The modem will keep falling back within the current modulation if necessary until the speed reaches 2400 bps (V.34) or 4800 bps (V.32). Below this rate, the modem will only do retrains if EQM thresholds are exceeded. If the EQM is sufficient for at least one minute, the modem will initiate a rate renegotiation to a higher speed within the current modulation speeds. The rate renegotiations will be done without a retrain if a V.32 bis connection is established.

Speeds attempted during fallback/fall forward are those shown to be available in the rate sequences exchanged during the initial connection. Fallback/fall forward is available in error correction and normal modes, but not in direct mode or synchronous mode with external clocks.

10.7.5   %L - Report Line Signal Level

Returns a value, which indicates the received signal, level. The value returned is a direct indication (DAA dependent) of the receive level at the MDP, **not** at the telephone line connector. For example, 009 = -9 dBm, 043 = -43 dBm, and so on.

Result Codes:

OK

10.7.6 %Q - Report Line Signal Quality

Reports the line signal quality (DAA dependent). Returns the higher order byte of the EQM value. Based on the EQM value, retrain or fallback/fall forward may be initiated if enabled by %E1 or %E2.

Command: AT%Q

Response: 015

Result Codes:

OK   If connected.

ERROR   If not connected, or connected in 300 bps, V.23, or fax modes.

10.7.7 %Un - Select µ-Law or A-Law Codec Type

This command selects µ-Law or A-Law codec type for V.90 and K56flex modulation. This command also stores the selected setting directly to NVRAM. The default value is country specific.

Command: %Un

n   Decimal number corresponding to the selected option.

     0   Selects µ-Law.

     1   Selects A-Law.

Result Codes:

OK   n = 0 or 1

ERROR   Otherwise.

10.8   AT* Command Set

10.8.1   **- Load Flash Memory

The linear flash memory uploader allows flash memory connected to the modem external memory bus to be upgraded with revised modem firmware. This process transfers (uploads) the upgraded modem firmware (data) from the host computer to the modem which transfers the data to the flash memory device. The linear flash memory downloader allows the flash memory connected to the modem external memory bus to read and saved. This process transfers (downloads) the current modem firmware (data) to the host computer. Uploading new firmware to the flash memory or downloading existing firmware from the flash memory device is a two-step process.

1. When the AT** command is issued, the modem firmware boot loader is invoked and the user will first load a flash load module (FLM) into the modem's RAM. If the user wishes to upload new firmware to the modem, he should load the uploader FLM. If the user wishes to download existing firmware from the modem, he should load the downloader FLM. In either case, the data transfer is done via an ASCII transfer. The FLM contains the programming algorithm for the flash memory device being programmed and any messages that may be sent during the load process.

2. If the user wishes to upload new firmware to the modem, then he will then load the new modem firmware which the uploader FLM will then program into the flash memory device. This transfer is done via XMODEM transfer. If the user wishes to download existing

firmware from the modem, then he will set up the host PC for XMODEM receive and the downloader FLM will begin to send the existing firmware from the flash memory to the host PC.

Procedure::

1. Install in the modem a flash memory programmed with the modem firmware or a blank flash memory.

2. Put the uploader FLM and downloader FLM files and the new modem firmware file (e.g., XmUL003.s37, XmDL003.s37, and 206s4712.S37) in an appropriate directory on the computer's hard disk.

3. Configure the communications application program for a DTE rate of between 9600 bps and 115200 bps and RTS/CTS flow control.

4. Check the modem for response by typing AT.

5. Initiate the download process using the AT** command. The Download flash code…" message appears upon issuing the AT** command.

6. Perform an ASCII transfer of the FLM file (e.g., XmUL003.s37 for uploading new firmware to the modem or XmDL003.s37 for downloading existing firmware from the modem) from the host computer to the modem RAM using an industry standard communications software or an equivalent process (ensure that all ASCII translation or pacing is turned off).

7. After the FLM has been loaded, if uploading new firmware to the modem, perform an XMODEM upload of the new modem firmware hex file (e.g., 206s4712.S37) from the host computer to the modem RAM using an industry standard communications software or an equivalent process. If downloading existing firmware from the modem, using an industry standard communications software or equivalent, put the host PC in XMODEM receive mode.

The following messages may occur during the uploading process:

Message	Description
Device not supported	Displayed if the FLM used does not support the flash memory that is installed on the board.
Wrong S37 format	Displayed if the modem firmware being uploaded is not in Motorola S3 format.
Record error	Displayed if there is an error while either uploading or downloading. If this occurs, the transfer should be aborted, and the user should restart at step 5.
Download abort	Displayed if the transfer is aborted before it is finished. If this occurs, the user should restart at step 5.
Erase fail	Displayed if the FLM is unable to erase the flash memory. If this occurs, the user should restart at step 5.
Download error, Re-Load	Displayed if there was an error when uploading or downloading. If this occurs, the user should restart at step 5.
Error, No H/W flow ctl	Displayed if RTS-CTS flow control is not set. If this occurs, the user should restart at step 3.
DTE timeout	Displayed if the DTE has stopped the XMODEM transfer process before it is finished. If this occurs, the user should restart at step 5.
Code doesn't match hardware	Displayed if the user is attempting to upload a firmware that either not the same model (parallel, serial, etc.), crystal frequency, or size (1Mbit, 2Mbit, etc.) as the firmware that is currently on the board. If this occurs, the FLM will abort and not allow the user to continue.
Device successfully programmed	Displayed by the FLM at the completion of a successful upload or download then the modem will do a cold start.

The uploader and downloader flash load modules (FLM) have several built in safety mechanisms to reduce the risk of a failed flash upload/download. The FLM will not allow a user to upload a firmware of different model (serial, parallel, etc.) or crystal speed than what is currently in the flash memory. Also, it will not allow the user to upload a firmware that is larger in size than the flash memory itself (e.g., a 2Mbit firmware onto a 1Mbit flash memory). It will, however, allow the user to upload a firmware that is smaller in size than the flash memory, and it will program the firmware with the appropriate offset in order for the firmware to function properly. In the instance that there is a failure during the download or upload process, the modem will be in a "flash rescue mode". In this mode, the modem will respond "OK" to all AT commands, but will only take action on the AT** command, so a new attempt to upload or download can be initiated. When the modem is in the "flash rescue mode" it will only be able to respond to AT commands if the DTE rate has not been changed since the last AT** command was successfully issued, even if the modem is powered off and on.

10.8.2   *B - Display Blacklisted Numbers

This command requests the modem to return a list of blacklisted numbers to the DTE. The format of the response is shown by the example below. Permanently forbidden numbers as defined by country requirements will not appear on this list. If no numbers are blacklisted, only the OK result code is issued.

Command: *B

Example: NO.   - PHONE NUMBER -

              ------   -----------------------------

              1;   4175537660

              2;   8288924961

              3;   3887278862

              4;   3124839442

              5;   6284664

              OK

10.8.3   *D - Display Delayed Numbers

This command causes the modem to send a list of the delayed numbers together with the delay associated with each. The modem will return a list of delayed telephone numbers as defined in the *B command. The format of the response is shown by the example below (delay times are shown as hours:minutes:seconds). If no numbers are delayed, only the OK result code is issued.

Command: *D

Example: NO.   - PHONE NUMBER   -DELAY

              ------   --------------------------   ---------------

              1;   8264734660   2:00:00

              2;   7532634661   2:00:00

              3;   2587334662   0:02:00

              4;   7532651663   0:03:25

              5;   7459931664   0:01:45

              OK

10.9   AT) Command Set

10.9.1   )Mn - Enable Cellular Power Level Adjustment

This command is included for compatibility only and has no effect other than returning a result code.

Command:)Mn

n   Decimal number corresponding to the selected option.

      0   )M0 command.

      1   )M1 command.

      2   )M2 command.

Result Codes:

OK   0 to 2.

ERROR   Otherwise.

10.10   At@ Command Set

10.10.1   @Mn - Initial Cellular Power Level Setting

This command is included for compatibility only and has no effect other than returning a result code.

Command: @Mn

n   Decimal number corresponding to the selected power setting.

    0   @M0 command.

    .

    .

    .

    30   @M30 command.

Result Codes:

OK   0 to 30.

ERROR   Otherwise.

10.11   AT: Command Set

10.11.1   :En - Compromise Equalizer Enable Command

This command is included for compatibility only and has no effect other than returning a result code.

Command: :En

n   Decimal number corresponding to the selected option.

    0   :E0 command.

    1   :E1 command.

Result Codes:

OK   0 or 1.

ERROR   Otherwise.

11   Modem S-Registers

The modem S-Registers are summarized below along with their default values; registers denoted with an '*' may be stored in one of the two user profiles by entering the &Wn command. One of these profiles may be loaded at any time by using the Zn command. Registers or register fields quoted as "reserved" are reserved for current or future use by the firmware, or are permanently overridden by PTT limitations.

All bit-mapped registers are read-only. The appropriate AT command which controls the relevant bits in the S-Register should be used to change the value.

The factory default values are stored in ROM and are loaded into the active configuration at power up or by the ATZn command. In addition, the designated default profile is subsequently loaded, and may change some of the factory default values. The designated default profile can be changed by entering the &Yn command where n is one of the two possible user profiles.

The defaults shown are those used by the modem in factory profiles zero and one. The factory default values may be loaded at any time by entering the &Fn command.

11.1   S0 - Number of Rings to Auto-Answer

Sets the number of the rings required before the modem automatically answers a call. Setting this register to zero disables auto-answer mode.

Range: 0-255 rings

> Default: 0

11.2   S1 - Ring Counter

S1 is incremented each time the modem detects a ring signal on the telephone line. S1 is cleared if no rings occur over an eight second interval.

Range: 0-255 rings

> Default: 0

11.3   S2 - Escape Character

S2 holds the decimal value of the ASCII character used as the escape character. The default value corresponds to an ASCII '+'. A value over 127 disables the escape process, i.e., no escape character will be recognized.

Range: 0-255, ASCII decimal

> Default: 43 (+)

11.4   S3 - Carriage Return Character

Sets the command line and result code terminator character. Pertains to asynchronous operation only.

Range: 0-127, ASCII decimal

> Default: 13 (Carriage Return)

11.5   S4 - Line Feed Character

Sets the character recognized as a line feed. Pertains to asynchronous operation only. The Line Feed control character is output after the Carriage Return control character if verbose result codes are used.

Range: 0-127, ASCII decimal

>   Default: 10 (Line Feed)

11.6   S5 - Backspace Character

S5 sets the character recognized as a backspace. Pertains to asynchronous operation only. The modem will not recognize the Backspace character if it is set to a value that is greater than 32 ASCII. This character can be used to edit a command line. When the echo command is enabled, the modem echoes back to the local DTE the Backspace character, an ASCII space character and a second Backspace character; this means a total of three characters are transmitted each time the modem processes the Backspace character.

Range: 0-32, ASCII decimal

>   Default: 8 (Backspace)

11.7   S6 - Wait Time before Blind Dialing or for Dial Tone

S6 operation is country dependent.

1.   Sets the length of time, in seconds, that the modem will wait before starting to dial after going off-hook when blind dialing. This operation, however, may be affected by some ATX options according to country restrictions. The "Wait for Dial Tone" call progress feature (W dial modifier in the dial string) will override the value in register S6. (US models.)

2.   Sets the length of time, in seconds, that the modem will wait for dial tone when encountering a "W" dial modifier before returning NO DIAL TONE result code. (W class.)

The modem always pauses for a minimum of 2 seconds, even if the value of S6 is less than 2 seconds.

Range: 2-255 seconds

>   Default: 2

11.8   S7 - Wait Time for Carrier, Silence, or Dial Tone

S7operation is country dependent.

1.   Sets the length of time, in seconds, that the modem will wait for carrier before hanging up. The timer is started when the modem finishes dialing (originate), or 2 seconds after going off-hook (answer). In originate mode, the timer is reset upon detection of answer tone if allowed by country restrictions.

2.   Sets the length of time, in seconds, that modem will wait for silence when encountering the @ dial modifier before continuing with the next dial string parameter.

3.   Sets the length of time, in seconds, that the modem will wait for dial tone when encountering a "W" dial modifier before continuing with the next dial string parameter. (US models.)

Range: 1-255 seconds

Default: 50

11.9   S8 - Pause Time For Dial Delay

S8 sets the time, in seconds, that the modem must pause when the "," dial modifier is encountered in the dial string.

Range: 0-255 seconds

Default: 2

11.10   S9 - Carrier Detect Response Time

S9 is supported for backwards compatibility only. No value can be written. Responds with default value.

Range: 6 tenths of a second

Default: 6 (0.6 second)

11.11   S10 - Lost Carrier To Hang Up Delay

S10 sets the length of time, in tenths of a second, that the modem waits before hanging up after a loss of carrier. This allows for a temporary carrier loss without causing the local modem to disconnect. When register S10 is set to 255, the modem functions as if a carrier is always present.

The actual interval the modem waits before disconnecting is the value in register S10 minus the value in register S9. Therefore, the S10 value must be greater than the S9 value or else the modem disconnects before it recognizes the carrier.

Range: 1-255 tenths of a second

Default: 14 (1.4 seconds)

Note:	For Call Waiting detection, if the modem is set to US country code and S10 >=16, then the modem will detect the Call Waiting tone and hang-up the line. If S10 <16, the modem will not detect Call Waiting tone.

11.12   S11 - DTMF Tone Duration

S11 operation is country dependent.

1.   For US models, S11 sets the duration of tones in DTMF dialing (has no effect on pulse dialing).

2.   For W-class models, S11 is a country parameter loaded by ConfigurACE.

Range: 50-255 milliseconds

Default: 95 (95 milliseconds)

11.13   S12 - Escape Prompt Delay (EPD)

S12 defines the maximum period, in fiftieths of a second, allowed between receipt of the last character of the three escape character sequence from the DTE and sending of the OK result code to the DTE. If any characters are detected during this time, the OK will not be sent. Sending of the OK result code does not affect entry into command mode.

Range: 0-255 1/50 of a second

Default: 50 (1 second)

11.14   S14 - General Bit Mapped Options Status

Indicates the status of command options.

Default: 138 (8Ah) (10001010b)

Bit 0   This bit is ignored.

Bit 1   Command echo (En)

    0 = Disabled (E0)

    1 = Enabled (E1) (Default.)

Bit 2   Quiet mode (Qn)

    0 = Send result codes (Q0) (Default.)

    1 = Do not send result codes (Q1)

Bit 3   Result codes (Vn)

    0 = Numeric (V0)

    1 = Verbose (V1) (Default.)

Bit 4   Reserved

Bit 5   Tone (T)/Pulse (P)

    0 = Tone (T) (Default.)

    1 = Pulse (P)

Bit 6   Reserved

Bit 7   Originate/Answer

    0 = Answer

    1 = Originate (Default.)

11.15   S16 - Test Mode Bit Mapped Options Status

S16 indicates the test in progress status.

Default: 0

Bit 0   Local analog loopback

    0 = Disabled (Default.)

    1 = Enabled (&T1)

Bits 1-7   Not used

11.16   S19 - Reserved

S19 is supported for backwards compatibility only. No value can be written. Responds with default value.

Range: None

    Default: 0

11.17   S20 - Reserved

S20 is supported for backwards compatibility only. No value can be written. Responds with default value.

Range: None

Default: 0

11.18   S21 - V.24/General Bit Mapped Options Status

S21 indicates the status of command options.

Default: 52 (34h) (00110100b)

Bits 0 - 1 Reserved (0)

Bit 2   CTS behavior (&Rn)

    0 = CTS tracks RTS (&R0)

    1 = CTS always on (&R1) (Default.)

Bits 3-4 DTR behavior (&Dn)

    0 = &D0 selected

    1 = &D1 selected

    2 = &D2 selected (Default.)

    3 = &D3 selected

Bit 5   RLSD (DCD) behavior (&Cn)

    0 = &C0 selected

    1 = &C1 selected (Default.)

Bit 6   DSR behavior (&Sn)

    0 = &S0 selected (Default.)

    1 = &S1 selected

Bit 7   Long space disconnect (Yn)

    0 = Y0 (Default.)

    1 = Y1

11.19   S22 - Speaker/Results Bit Mapped Options Status

S22 indicates the status of command options.

Default: 117 (75h) (01110101b)

Bits 0-1 Speaker volume (Ln)

    0 = Off (L0)

    1 = Low (L1) (Default.)

    2 = Medium (L2)

    3 = High (L3)

Bits 2-3 Speaker control (Mn)

    0 = Disabled (M0)

    1 = Off on carrier (M1) (Default.)

    2 = Always on (M2)

    3 = On during handshake (M3)

Bits 4-6 Limit result codes (Xn)

    0 = X0

    4 = X1

    5 = X2

    6 = X3

    7 = X4 (Default.)

Bit 7 Reserved

11.20   S23 - General Bit Mapped Options Status

S23 indicates the status of command options.

Default: 0

Bits 0-6   Not used

Bits 6-7   Guard tone (&Gn)

    0 = None (&G0) (Default.)

    1 = None (&G1)

    2 = 1800 Hz (&G2)

11.21   S24 - Sleep Inactivity Timer

S24 sets the length of time, in seconds, that the modem will operate in normal mode with no detected telephone line or DTE line activity before entering low-power sleep mode. The timer is reset upon any DTE line or telephone line activity. If the S24 value is zero, neither DTE line nor telephone inactivity will cause the modem to enter the sleep mode.

Range: 0-255 seconds

    Default: 0

11.22   S25 - Delay To DTR off

S25 sets the length of time that the modem will ignore DTR for taking the action specified by &Dn. Its units are seconds for synchronous modes and one hundredths of a second for other modes.

Range: 0-255 (1 second for synchronous modes 1; 0.01 second otherwise)

    Default: 5

11.23   S26 - RTS to CTS Delay

S26 sets the time delay, in hundredths of a second, before the modem turns CTS ON after detecting an OFF-to-ON transition on RTS when &R0 is commanded. Pertains to synchronous operation only.

Range: 0-255 hundredths of a second

Default: 1

11.24   S27 - Bit Mapped Options Status

S27 indicates the status of command options.

Default: 73 (49h) (01001001b)

Bits 0,1,3 Synchronous/asynchronous selection (&Mn/&Qn)

3	**1**	**0**	
0	0	0	= &M0 or &Q0
0	0	1	= &M1 or &Q1
0	1	0	= &M2 or &Q2
0	1	1	= &M3 or &Q3
1	0	0	= Reserved
1	0	1	= &Q5 (Default.)
1	1	0	= &Q6

Bit 2   Leased line control (&Ln)

            0 = Dial up line (&L0) (Default.)

Bits 4 - 5   Internal clock select (&Xn)

            0 = Internal clock (&X0) (Default.)

            1 = External clock (&X1)

            2 = Slave clock (&X2)

Bit 6   CCITT/Bell mode select (Bn)

            0 = CCITT mode (B0)

            1 = Bell mode (B1) (Default.)

Bit 7 - Reserved

11.25   S28 - Bit Mapped Options Status

S28 indicates bit mapped options status.

Default: 0

Bits 0 - 1   Reserved

Bit 2   Reserved (always 0).

Bits 3 - 4   Pulse dialing (&Pn)

            0 = 39%-61% make/break ratio at 10 pulses per second (&P0) (Default.)

            1 = 33%-67% make/break ratio at 10 pulses per second (&P1)

            2 = 39%-61% make/break ratio at 20 pulses per second (&P2)

            3 = 33%-67% make/break ratio at 20 pulses per second (&P3)

Bit 5-7 Reserved

11.26   S29 - Flash Dial Modifier Time

S29 sets the length of time, in units of 10 ms, that the modem will go on-hook when it encounters the flash (!) dial modifier in the dial string. The time can be limited as it is a country dependent parameter.

Range: 0-255 10 ms intervals

Default: 70 (700 ms)

11.27   S30 - Disconnect Inactivity Timer

S30 sets the length of time, in tens of seconds, that the modem will stay online before disconnecting when no data is sent or received. In error-correction mode, any data transmitted or received will reset the timer. In other modes, any data transmitted will reset the timer. The timer is inoperative in synchronous mode.

Range: 0-255 tens of seconds (0-2550 seconds)

Default: 0 (disabled)

11.28   S31 - Bit Mapped Options Status

S31 indicates bit mapped options status.

Default: 192 (C0h) (11000000b)

Bit 0   Single line connect message enable/disable (\Vn)

0 = Messages controlled by S95, Wn and Vn (\V0) (Default)

1 = Single line connect message (\V1)

Bit 1   Reserved (0)

Bits 2-3 Error correction progress messages (Wn)

0 = DTE speed only (W0) (Default)

1 = Full reporting (W1)

2 = DCE (line) speed only (W2)

Bits 4-5 Caller ID (#CID)

0 = Caller ID disabled (#CID=0) (Default)

1 = Short (formatted) Caller ID enabled (#CID=1)

2 = Long (unformatted) Caller ID enabled (#CID=2)

Bits 6-7 Reserved (Default = 11b)

11.29   S36 - LAPM Failure Control

Default: 7 (00000111b)

Bits 0-2   This value indicates what should happen upon a LAPM failure. These fallback options are initiated immediately upon connection if S48=128. If an invalid number is entered, the number is accepted into the register, but S36 will act as if the default value has been entered.

0 = Modem disconnects.

1 = Modem stays on-line and a Direct mode connection is established.

2 = Reserved.

3 = Modem stays on-line and a Normal mode connection is established.

4 = An MNP connection is attempted and if it fails, the modem disconnects.

5 = An MNP connection is attempted and if it fails, a Direct mode connection is established.

6 = Reserved.

7 = An MNP connection is attempted and if it fails, a Normal mode connection is established. (Default.)

Bits 3-7   Reserved

11.30   S38 - Delay Before Forced Hang Up

S38 specifies the delay between the modem's receipt of the H command to disconnect (or ON-to-OFF transition of DTR if the modem is programmed to follow the signal), and the disconnect operation. Applicable to error-correction connection only. This parameter can be used to ensure that data in the modem buffer is sent before the modem disconnects.

1.   If S38 is set to a value between 0 and 254, the modem will wait that number of seconds for the remote modem to acknowledge all data in the modem buffer before disconnecting. If time expires before all data is sent, the NO CARRIER result code will be issued to indicate that data has been lost. If all data is transmitted prior to time-out, the response to the H0 command will be OK.

2.   If S38 is set to 255, the modem does not time-out and continues to attempt to deliver data in the buffer until the connection is lost or the data is delivered.

Range: 0-255 seconds

       Default: 20

11.31   S39 - Flow Control Bit Mapped Options Status

Default: 3 (00000011b)

Bits 0-2   Status of command options

               0 = No flow control

               3 = RTS/CTS (&K3) (Default.)

               4 = XON/XOFF (&K4)

               5 = Transparent XON (&K5)

               6 = Both methods (&K6)

Bits 3-7   Reserved

11.32   S40 - General Bit Mapped Options Status

S40 indicates the status of command options.

Default: 104 (68h) (01101000b)

Bits 0-1   MNP Extended Services (-Kn)

                  0 = Disable extended services (-K0) (Default)

                  1 = Enable extended services (-K1)

                  2 = Enable extended services (-K2)

Bit 2   Reserved

Bits 3-5   Break Handling (\Kn)

                  0 = \K0

                  1 = \K1

                  2 = \K2

                  3 = \K3

                  4 = \K4

                  5 = \K5 (Default.)

Bits 6-7   Reserved

11.33   S41 - General Bit Mapped Options Status

S41 indicates the status of command options.

Default: 13 (C3h) (00001101b)

Bits 0 -1   Compression selection (%Cn)

                  0 = Disabled (%C0)

                  1 = MNP 5 (%C1)

                  2 = V.42 bis (%C2)

                  3 = MNP 5 and V.42 bis (%C3) (Default.)

Bits 2, 6   Auto retrain and fallback/fall forward (%En)

         Bit 6   Bit 2

         0   0   = Retrain and fallback/fall forward disabled (%E0)

         0   1   = Retrain enabled (%E1)

         1   0   = Fallback/fall forward enabled (%E2) (Default.)

Bit 3   Reserved

Bits 4-5   Reserved

Bit 7   Reserved

11.34   S46 - Data Compression Control

S46 controls selection of compression. The following actions are executed for the given values:

Range: 136 or 138

      Default: 138

S46=136 Execute error correction protocol with no compression.

S46=138 Execute error correction protocol with compression. (Default.)

11.35   S48 - V.42 Negotiation Action

The V.42 negotiation process determines the capabilities of the remote modem. However, when the capabilities of the remote modem are known and negotiation is unnecessary, this process can be bypassed if so desired.

Range: 0, 7, or 128 If an invalid number is entered, it is accepted into the S-Parameter, but S48 will act as if 128 has been entered.

Default: 7

S48=0   Disable negotiation; bypass the detection and negotiation phases; and proceed with LAPM.

S48=7   Enable negotiation. (Default.)

S48=128   Disable negotiation; bypass the detection and negotiation phases; and proceed at once with the fallback action specified in S36. Can be used to force MNP.

11.36   S86 - Call Failure Reason Code

When the modem issues a NO CARRIER result code, a value is written to S86 Register to help determine the reason for the failed connection. S86 records the first event that contributes to a NO CARRIER message. The code definitions are:

Range: 0-26

Default: 21

S86=0 Normal hangup, no error occurred.

S86=1 Reserved.

S86=2 Reserved.

S86=3 Call Waiting caused disconnect.

S86=4 Physical carrier loss.

S86=5 No error correction at the other end.

S86=6 No response to feature negotiation.

S86=7 This modem is async only; the other modem is sync only.

S86=8 No framing technique in common.

S86=9 No protocol in common.

S86=10 Bad response to feature negotiation.

S86=11 No sync information from the remote modem.

S86=12 Normal hangup initiated by the remote modem.

S86=13 Retransmission limit reached.

S86=14 Protocol violation occurred.

S86=15 Lost DTR.

S86=16 Received GSTN cleardown.

S86=17 Inactivity timeout.

S86=18 Speed not supported.

S86=19 Long space disconnect.

S86=20 Key abort disconnect.

S86=21 Clears previous disconnect reason.

S86=22 No connection established.

S86=23 Disconnect after three retrains.

S86=24 Call Waiting tone detected.

S86=25 Extension pickup detected.

S86=26 Remote hangup detected.

11.37   S91 - PSTN Transmit Attenuation Level

In non-PCM modes (V.90 or K56flex are PCM modes), S91 sets the transmit attenuation level from 0 to 15 dBm for the PSTN mode, resulting in a transmit level from 0 to -15 dBm. In some countries, the transmit level may not be changed and there are checks to prevent transmit attenuation level change using ConfigurACE.

Range: 0 to 15 dBm (Corresponding to 0 to -15 dBm transmit level.)

Default: 10 (-10 dBm transmit level.)

11.38   S92 - Fax Transmit Attenuation Level

S92 sets the transmit attenuation level from 0 to 15 dBm for the fax mode, resulting in a transmit level from 0 to -15 dBm. In some countries, the transmit level may not be changed and there are checks to prevent transmit attenuation level change using ConfigurACE.

Range: 0 to 15 dBm (Corresponding to 0 to -15 dBm transmit level.)

Default: 10 (-10 dBm transmit level.)

11.39   S95 - Extended Result Codes

A bit set to a 1 in this parameter, in conjunction with the W command, will enable the corresponding extended result code.

The +MR, +ER, and +DR settings also control S95 bits 2, 3, and 5, respectively. The more recent settings of +MR, +ER, and +DR, or host writing of S95 bits 2, 3, and 5, along with the W command setting, determine the corresponding actual result code reporting (see +MR, +ER, DR, and W commands).

Default: 0

Bit 0   CONNECT result code indicates DCE speed instead of DTE speed.

Bit 1   Append/ARQ to CONNECT XXXX result code in error-correction mode (XXXX = rate).

Bit 2   Enable +MCR: XXXX result code (XXXX = modulation) and +MRR: XXXX result code (XXXX = rate). (Also, see +MR.)

Bit 3   Enable +ER: XXXX result code (XXXX = protocol identifier).

Bit 4   Reserved.

Bit 5   Enable +DR: XXXX result code (XXXX = compression type).

Bits 6-7 Reserved.

11.40   S210 – V.34 Symbol Rates

The bits in this parameter control V.34 symbol rates and enables/disables V.34 asymmetric rates. This parameter is used for diagnostic purpose only.

Default: 13 (0Dh) (00001101b)

Bits 0 -2 Selects the range of allowed V.34 symbol rates.

2	1	0	Symbol Rates (baud)
0	0	0	= 2400 only
0	0	1	= 2400 only (no 2734)
0	1	0	= 2400, 2800
0	1	1	= 2400, 2800, 3000
1	0	0	= 2400, 2800, 3000, 3200
1	0	1	= 2400, 2800, 3000, 3200, 3429 (Default)

Bit 3   Enable/disable V.34 asymmetric rates.

0 = Disable asymmetric rates

1 = Enable asymmetric rates (Default)

Bits 4-7 Reserved.

Examples

S210=13 Enable asymmetric rates with all symbol rates available (Default).

S210=5 Disable asymmetric rates with all symbol rates available.

S210=8 Enable asymmetric rates with only 2400 baud available.

S210=11 Enable asymmetric rates with 2400 to 3000 baud available.

12 Modem Result Codes

The modem responds to commands from the DTE and to activity on the line by signaling to the DTE in the form of result codes. The result codes that the modem can send are described below. Two forms of each result code are available: long-form, an English-like "verbose" response, and short-form, a data-like numeric response (included in parentheses following the long-form). The long-form code is preceded and terminated by the sequence < CR> < LF>. The short-form is terminated by < CR>, only with no preceding sequence. If result messages are suppressed, nothing is returned to the DTE.

Short Form	Long Form	N Value in ATXn Command					Notes
		0	1	2	3	4	
+F4	+FCERROR	X	X	X	X	X	
0	OK	X	X	X	X	X	
1	CONNECT	X	X	X	X	X	
2	RING	X	X	X	X	X	
3	NO CARRIER	X	X	X	X	X	
4	ERROR	X	X	X	X	X	
5	CONNECT 1200	1	X	X	X	X	
6	NO DIALTONE	3	3	X	X	X	
7	BUSY	3	3	3	X	X	
8	NO ANSWER	X	X	X	X	X	
9	CONNECT 600	1	X	X	X	X	
10	CONNECT 2400	1	X	X	X	X	
11	CONNECT 4800	1	X	X	X	X	
12	CONNECT 9600	1	X	X	X	X	
13	CONNECT 7200	1	X	X	X	X	
14	CONNECT 12000	1	X	X	X	X	
15	CONNECT 14400	1	X	X	X	X	
16	CONNECT 19200	1	X	X	X	X	
17	CONNECT 38400	1	X	X	X	X	
18	CONNECT 57600	1	X	X	X	X	
19	CONNECT 115200	1	X	X	X	X	
20	CONNECT 230400	X	X	X	X	X	
22	CONNECT 75TX/1200RX	1	X	X	X	X	
23	CONNECT 1200TX/75RX	1	X	X	X	X	
24	DELAYED	4	4	4	4	X	
32	BLACKLISTED	4	4	4	4	X	
33	FAX	X	X	X	X	X	
35	DATA	X	X	X	X	X	
40	+MRR: 300	X	X	X	X	X	
44	+MRR: 1200/75	X	X	X	X	X	
45	+MRR: 75/1200	X	X	X	X	X	

46	+MRR: 1200	X	X	X	X	X	
47	+MRR: 2400	X	X	X	X	X	
48	+MRR: 4800	X	X	X	X	X	
49	+MRR: 7200	X	X	X	X	X	
50	+MRR: 9600	X	X	X	X	X	
51	+MRR: 12000	X	X	X	X	X	
52	+MRR: 14400	X	X	X	X	X	
53	+MRR: 16800	X	X	X	X	X	
54	+MRR: 19200	X	X	X	X	X	
55	+MRR: 21600	X	X	X	X	X	
56	+MRR: 24000	X	X	X	X	X	
57	+MRR: 26400	X	X	X	X	X	
58	+MRR: 28800	X	X	X	X	X	
59	CONNECT 16800	1	X	X	X	X	
61	CONNECT 21600	1	X	X	X	X	
62	CONNECT 24000	1	X	X	X	X	
63	CONNECT 26400	1	X	X	X	X	
64	CONNECT 28800	1	X	X	X	X	
66	+DR: ALT	X	X	X	X	X	
67	+DR: V42B	X	X	X	X	X	
69	+DR: NONE	X	X	X	X	X	
70	+ER: NONE	X	X	X	X	X	
77	+ER: LAPM	X	X	X	X	X	
78	+MRR: 31200	X	X	X	X	X	
79	+MRR: 33600	X	X	X	X	X	
80	+ER: ALT	X	X	X	X	X	
81	+ER: ALT-CELLULAR	X	X	X	X	X	
83	LINE IN USE	X	X	X	X	X	
84	CONNECT 33600	1	X	X	X	X	
91	CONNECT 31200	1	X	X	X	X	
134	+MCR: B103	X	X	X	X	X	
135	+MCR: B212	X	X	X	X	X	
136	+MCR: V21	X	X	X	X	X	
137	+MCR: V22	X	X	X	X	X	
138	+MCR: V22B	X	X	X	X	X	
139	+MCR: V23	X	X	X	X	X	
140	+MCR: V32	X	X	X	X	X	
141	+MCR: V32B	X	X	X	X	X	
142	+MCR: V34	X	X	X	X	X	
144	+MCR: K56	X	X	X	X	X	Note 2
145	+MCR: V90	X	X	X	X	X	Note 2
150	+MRR: 32000	X	X	X	X	X	Note 2
151	+MRR: 34000	X	X	X	X	X	Note 2

152	+MRR: 36000	X	X	X	X	X	Note 2
153	+MRR: 38000	X	X	X	X	X	Note 2
154	+MRR: 40000	X	X	X	X	X	Note 2
155	+MRR: 42000	X	X	X	X	X	Note 2
156	+MRR: 44000	X	X	X	X	X	Note 2
157	+MRR: 46000	X	X	X	X	X	Note 2
158	+MRR: 48000	X	X	X	X	X	Note 2
159	+MRR: 50000	X	X	X	X	X	Note 2
160	+MRR: 52000	X	X	X	X	X	Note 2
161	+MRR: 54000	X	X	X	X	X	Note 2
162	+MRR: 56000	X	X	X	X	X	Note 2
165	CONNECT 32000	X	X	X	X	X	Note 2
166	CONNECT 34000	X	X	X	X	X	Note 2
167	CONNECT 36000	X	X	X	X	X	Note 2
168	CONNECT 38000	X	X	X	X	X	Note 2
169	CONNECT 40000	X	X	X	X	X	Note 2
170	CONNECT 42000	X	X	X	X	X	Note 2
171	CONNECT 44000	X	X	X	X	X	Note 2
172	CONNECT 46000	X	X	X	X	X	Note 2
173	CONNECT 48000	X	X	X	X	X	Note 2
174	CONNECT 50000	X	X	X	X	X	Note 2
175	CONNECT 52000	X	X	X	X	X	Note 2
176	CONNECT 54000	X	X	X	X	X	Note 2
177	CONNECT 56000	X	X	X	X	X	Note 2
178	CONNECT 230400	X	X	X	X	X	
180	CONNECT 28000	X	X	X	X	X	Note 2
181	CONNECT 29333	X	X	X	X	X	Note 2
182	CONNECT 30667	X	X	X	X	X	Note 2
183	CONNECT 33333	X	X	X	X	X	Note 2
184	CONNECT 34667	X	X	X	X	X	Note 2
185	CONNECT 37333	X	X	X	X	X	Note 2
186	CONNECT 38667	X	X	X	X	X	Note 2
187	CONNECT 41333	X	X	X	X	X	Note 2
188	CONNECT 42667	X	X	X	X	X	Note 2
189	CONNECT 45333	X	X	X	X	X	Note 2
190	CONNECT 46667	X	X	X	X	X	Note 2
191	CONNECT 49333	X	X	X	X	X	Note 2
192	CONNECT 50667	X	X	X	X	X	Note 2
193	CONNECT 53333	X	X	X	X	X	Note 2
194	194 CONNECT 54667	X	X	X	X	X	Note 2
195	195 +MRR: 28000	X	X	X	X	X	Note 2
196	+MRR: 29333	X	X	X	X	X	Note 2
197	+MRR: 30667	X	X	X	X	X	Note 2

198	+MRR: 33333	X	X	X	X	X	Note 2
199	+MRR: 34667	X	X	X	X	X	Note 2
200	+MRR: 37333	X	X	X	X	X	Note 2
201	+MRR: 38667	X	X	X	X	X	Note 2
202	+MRR: 41333	X	X	X	X	X	Note 2
203	+MRR: 42667	X	X	X	X	X	Note 2
204	+MRR: 45333	X	X	X	X	X	Note 2
205	+MRR: 46667	X	X	X	X	X	Note 2
206	+MRR: 49333	X	X	X	X	X	Note 2
207	+MRR: 50667	X	X	X	X	X	Note 2
208	+MRR: 53333	X	X	X	X	X	Note 2
209	+MRR: 54667	X	X	X	X	X	Note 2

NOTES:

1.   An 'x' in a column indicates that the message (either the long form if verbose, or the value only for short form) will be generated when that particular value of 'n' (shown at the top of the column) has been selected by the use of ATXn. If the column is blank, then no message will be generated for that x option. A numeral indicates which less explicit message (verbose or short form) will be output for that X option.

2.   RC56 modems.